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THE AMERICAN GAS LIGHT JOURNAL

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Correspondence.—Wishing to make this JOURNAL a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of those subjects a pleasure or a profession.

The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

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BRIEFLY TOLD.

THE WELSBACH STREET LIGHTING COMPANY.—One of the questions discussed at the last meeting of the American Gas Light Association was this: "Is it advantageous or beneficial for gas companies to encourage the lighting of streets with self-generators or naphtha burners beyond their mains?" While the question might have been put in clearer way, so far as word construction goes, it nevertheless is plain as to intent. In former times the projectors of the naphtha street lighting companies were not content to seek business in locations unoccupied by gas companies; in fact, quite to the contrary, they often proved active competitors for street lighting in cities supplied with gas, and their bids for such lighting were made against the bids of the gas companies for any or all of the work to be done. That style of competition naturally antagonized the gas companies, and the result was, of course, the engendering of a hostility, some trace or remnants of which exist to this day. However, with the advent of a lively competitor for street lighting in the shape of electricity (either arc or incandescent), it became a matter of the union of forces, and the net result seems to be that both the naphtha and regular gas interests can work harmoniously and profitably together. The tenor of the discussion on the question was undoubtedly and pronouncedly in favor of an affirmative to the query, and Mr. Miller's exposition of the reasons that caused him to assent to the proposition were forceful and logical; they were also practical, since they sprang from an actual trial in the premises. Mr. Prendergast, of the Welsbach Street Lighting Company, having been invited to speak on the topic, clearly outlined the purpose and object of that Company; and his statement should silence any objector to its good faith, in that he remarked, "The Company now had control of the Welsbach lamp for street lighting, and it proposed to work in complete harmony with the views of existing gas companies. The latter were those who could dictate the terms; the Welsbach Street Lighting Company would carry them out." In that presentation there is no ambiguity; no sign of intention to act as a competitor. The Welsbach street lamp, used in connection with naphtha vapors, can be safely counted on to do excellent work in any district not reached by the main system of the local gas company; and the business thus established can be taken over by the gas company and carried out in the regular way when the general growth of the district warrants the placing of gas mains therein. The scheme looks to be a good one, particularly in view of the statement of the Welsbach Company's representative that the gas companies "could dictate the terms." Under other condition than the latter the plan might not be so acceptable.

LEAKAGE.—One of the "short topics" for discussion presented at the last meeting of the American Association was proposed by Mr. J. M. Rusby, of Jersey City, N. J., who addressed himself to the old-new, ever present, perplexing and costly matter of leakage. His remarks, which will be found on page 806 of this issue, are so clearly put together that comment on our part, by way of elucidation, is altogether out of the question. We cannot refrain, however, from remarking that his ways and means of locating and remedying leakage are plain enough and fit enough to be followed in other places with advantage and profit; and we have no doubt whatever that such will be the pleasing outcome of his contribution to the Association's records.

NOTES.—The Consolidated Gas Company, of Baltimore, has declared a dividend of 2 per cent., payable December 1st.——The New York, Rutherford and Suburban Gas Company, of Rutherford, N. J., has applied for the right to distribute gas in the outlying district of Woodridge.——It is reported that the properties of the Lebanon (Pa.) Gas Company are about to change hands. The further suggestion is made that the likely purchaser is the United Gas Improvement Company.——The residents of Brewer City, Maine, are endeavoring to induce the Bangor Gas Company to extend its main system to and through the streets of Brewer City.——Mr. Jacob P. Miller, Secretary of the Equitable Gas Light Company, of New York,

has notified the shareholders that a special meeting has been called, for the 27th inst., at 11 A.M., for the "purpose of submitting to said stockholders for their approval an agreement of consolidation between the Company and the New York and East River Gas Company and the New Amsterdam Gas Company."——MayorWarwick, of Philadelphia, has signed the ordinance under which the Philadelphia municipal gas plant has been leased for a period of 30 years to the United Gas Improvement Company.

Determination of the Value of Mineral Oils for Gas Manufacture.

The *Gas World* notes that in a recent number of the "Zeitschrift für Angewandete Chemie" Dr. Helfers contributed an interesting article upon the above subject, which will be of interest to the chemists and superintendents of gas works. As these oils have previously been analyzed principally with reference to boiling point, density, content of creosote, and calorific power, all of which gave a relative basis for comparison for the oils, but said nothing about the purpose for which they were to be used, it was thought desirable to devise some tests which would give the gas value direct. This test was difficult to make, and generally inexact, and required 2.5 to 40 gallons of oil in each operation. Again, an installation of this kind is too complicated and expensive for individual laboratories or oil gas works; but this difficulty has been overcome by the use of the Wernecke apparatus, which gives exact results with quantities as low as 1.4 ounces.

The apparatus consists of a furnace surrounded by asbestos and provided with adjustable feet to keep it vertical. It carries at the top a series of jets arranged in a circle, and also two openings, the lower one to light the flame, and the upper one covered with mica, through which to examine the retort. The Bunsen burner which heats the retort is introduced through an opening in a circular plate at the bottom of the cylindrical casing. From the top of the furnace the retort projects and carries the feed pipe and the gas exit pipe, the former being bent in the shape of a U, the end reaching into a glass cylinder. The branch of the U-tube entering the retort is so constructed, by the aid of a stem and plug, that the flow of oil from the tube can be cut off at any time, thus allowing the pressure to be noted and the exact amount of oil not burned to be accurately determined. From the opening of the exit pipe under the distributing mushroom the gas escapes. The oil falls upon this mushroom, distributes itself uniformly upon the surface, and gasifies in descending. To prevent clogging, a stem provided with scrapers is introduced through the retort plug.

Both gas and tar vapors pass from the retort into a cylindrical receiver whose base terminates in a cone and carries a valve; the gaseous products escape from thence into a tar separator surrounded by wire gauze. The exit tubes from the separator enter two glass bulbs to increase their condensing surface. The gas then passes into a gasholder, from which it goes into a meter, and is then tested photometrically.

Table 1 gives results thus obtained by four different experimenters; Table 2 gives a comparison of results with full size and Wernecke apparatus.

	Dr. Henricl.	Dr. Daimant.		Dr. Eisenlopr.						Dr. Helfers.
Gas produced per ton of oil; cubic feet	19,988	22,736	19,460	21,135	19,636	21,204	21,925	17,422	19,711	20,575
Coke produced; percentage weight	7.37	9.64	5.51	8.70	5.15	9.20	9.56	3.84	5.85	6.69
Tar produced; percentage weight	41.83	35.15	41.63	37.60	39.95	40.11	36.38	42.88	38.07	40.60
Actual lighting power; consumption 5 cu ft. per hour; English candles	38.22	28.36	40.35	31.00	40.55	28.03	27.60	50.96	39.07	35.04
Calculated lighting power with a consumption of 5 cu. ft. per hour; English candles	48.67	48.76	49.01	48.50	49.35	47.06	49.22	48.42	48.20	49.44

	Full Sized Apparatus, No. 1.		Full sized Apparatus, No. 2.	Wernecke Apparatus.	
First Test.					
Gas produced per ton of oil; cubic feet	18,660	19,019	21,757	21,495	23,343
Actual lighting power, 5 cubic feet per hour; English candles	42.47	38.91	28.46	27.61	21.24
Calculated lighting power, 5 cubic feet per hour; English candles	46.55	44.93	46.25	44.47	43.57
Second Test.					
Gas produced per ton of oil; cubic feet	18,660	19,786	21,965	20,250	23,856
Actual lighting power, 5 cubic feet per hour; English candles	38.91	35.38	26.33	26.10	23.36
Calculated lighting power, 5 cubic feet per hour; English candles	48.02	44.93	44.81	47.99	46.80

[Abstract of Proceedings.—Concluded from Page 772.]

TWENTY-FIFTH ANNUAL MEETING, AMERICAN GAS LIGHT ASSOCIATION.

Held in Hotel Chamberlin, Fort Monroe, Va., October 20, 21 and 22, 1897.

Second Day—Afternoon Session—October 21.

The President introduced Mr. T. Littlehales, of Syracuse, N. Y., who read the following "short topic" for discussion, entitled

SOME FACTS AND FIGURES ON THE TESTING OF CONSUMERS' METERS.

The data that I have the honor to place before the Association, while it does not rise to the dignity of a paper, is nevertheless accurate and reliable, and will, it is hoped, be found useful, especially to the younger members who have not had opportunities to acquire such information themselves.

When I took charge of the Syracuse gas works (to follow my esteemed friend, Mr. Austin C. Wood), among other things it was decided to have the whole of the consumers' meters tested and overhauled, which work is now well advanced. The facts here submitted are up to 23rd September, 1897, and on a total of 5,427 meters already tested. The record is as follows:

Syracuse (N. Y.) Gas Company—Record of Meter Testing.

Percentage of Error.	Fast.		Slow.	
	No. Meters.	Points Fast.	No. Meters.	Points Slow.
1 per cent.	538	538	687	678
2 "	559	1,118	697	1,394
3 "	277	731	419	1,257
4 "	157	628	392	1,568
5 "	105	525	182	900
6 "	56	336	297	1,782
7 "	21	147	74	518
8 "	7	56	87	696
9 "	4	36	51	459
10 "	10	100	48	480
11 "	1	11	11	121
12 "	5	60	28	386
13 "	2	26	6	78
14 "	1	14	6	84
15 "	....	....	14	210
16 "	....	....	5	80
17 "	....	....	5	85
18 "	1	18	6	108
19 "	....	....	3	57
20 "	....	....	5	100
22 "	....	....	3	66
24 "	....	....	1	24
25 "	....	....	5	125
26 "	....	....	1	26
30 "	....	1	....	30
32 "	....	....	1	32
	1,744	4,344	3,035	11,303

Total number of meters tested, Sept. 23, 1897		5,427
Meters fast, as per previous table	1,744	
Meters slow, as per previous table	3,035	
Meters correct (less than 1 per cent. variation)	616	
Meters not registering	31	
Meters not passing gas	1	
		5,427
Total number of points slow		11,303
Total number of points fast		4,344
Total error equals, points slow		6,959

Equal (on 4,779 meters in error) to 1.44 per cent. slow.

One point in the foregoing record to which I wish to call special attention is in reference to the comparatively few meters that ran over 7 per cent. fast—31 in all. I might say that, in my previous 30 years' experience, I have scarcely ever met with a meter over 8 per cent. fast, while there has been no limit to the percentage of error on the slow side; consequently I gave special personal attention to the cause of this variation from my previous experience. The trouble is in the dia-

phragms—whether the cause be insufficient care in the selection of the skins, or, as has been explained to the writer by one maker, "Their desire to produce a meter that would work with the least possible pressure, carried them too far in the use of light leathers, the fact is that the trouble is caused by too thin skins." Where this defect is found it is invariably in meters of the larger sizes, 10-light, 20-light and upwards, in which the upper portion of the diaphragm collapses and doubles inwards, preventing the full inflation which should take place, and this reduces the capacity of the diaphragm. While it may be presumed that all the meter makers are now aware of this fact, and those makers, in whose products the weakness was found, have corrected the defect in the meters now being put out; yet, as there are a great many of these defective meters (made in past years) still in operation, it should make it all the more incumbent on the gas manager to keep a watchful eye on these old meters, although it is only just and right to say that the products of some meter factories are almost entirely free from this defect.

Some years ago General Hickenlooper gave us the benefit of valuable data on this subject, which has constantly been used as a text, and deservedly so.

As the meter is the arbiter between the gas companies and their customers, and is wholly under the control and supervision of the gas company, it is an imperative duty to have every meter in such shape that we can, with the greatest confidence, bring one in and set it on the tester, in the presence of the consumer, feeling sure that it will come out as nearly as possible to correctness every time; and to establish in the minds of the consumer, and to be able to maintain beyond a doubt or question what every gas man knows to be a fact, that there is no other piece of machinery in existence that has had the rough usage and on which so much depends that can be more thoroughly relied upon for general accuracy than the much maligned gas meter; and, not withstanding the fact that errors do occur, and meters are occasionally found defective, where the errors exist they are much more in favor of the consumer than of the gas company.

I will show you the diaphragm I speak of, indicating where this trouble exists. I do not think it it will be found in the meters now made, but it is found in the old make meters. *This* (indicating) is one of the diaphragms I referred to. It doubled up in the shape you see it—collapsing and then doubling inwards—instead of the leather being like *that*, it had collapsed, and had taken in a portion of the chamber. I found that tendency in a large number of meters with thin skins.

Discussion.

Mr. Searle asked Mr. Littlehales if error over all of the meters tested was in the neighborhood of 1 per cent.

Mr. Littlehales replied that the total difference so far as the company was concerned was 1.44 per cent. slow.

Mr. Searle asked if Mr. Littlehales claimed that such differences in meters were comparatively unimportant in estimating unaccounted for gas.

Mr. Littlehales replied in the affirmative. He also stated that his figures referred to the average error concerning, to all intent and purpose, all the meters in use. In estimating or arriving at the total of unaccounted-for gas, the principal factors to be considered were the mains, condensation, services and meters. So far in Syracuse their tests had shown that in the general statement of unaccounted-for gas the item of meters was responsible for a shrinkage of 1.44 per cent.

Mr. Thompson hoped that Mr. Littlehales, before his paper was printed in the proceedings, would prepare a supplementary table reducing the total loss to percentage slow in one light meters; for there was such a thing as a 50-light or 100 light meter being 5 per cent. slow, and that a 5-light meter would only be equally slow, whence the average of the two, so far as per cent. slow was concerned, would be equal, whereas the quantity of gas lost would be altogether out of proportion.

Mr. Jenkins thought the better way to get at it would be to determine the percentage of loss or otherwise of gas through meters by comparing the percentage fast or slow with the average quantity of gas actually used by the consumer for six months or a year.

Mr. Somerville thought with Mr. Littlehales that a very great source of trouble in gas meters, particularly in large ones, arose from the collapsing of diaphragms. He had had much annoyance from such collapses.

Mr. Littlehales closed the discussion by saying that his remarks about the collapsing of diaphragms referred to meters made some years ago, many of which meters, of course, were still in use. He thought the meters made in the present time were quite free from that objection.

On motion of Mr. Beal a vote of thanks was passed to Mr. Littlehales.

The President next introduced Mr. Alten S. Miller, of Long Island City, N. Y., who read the following paper on

SOME FURTHER EXPERIMENTS ON INTERIOR ILLUMINATION.

The paper presented by Mr. Page at our last meeting, giving the result of some novel experiments on the reflection of light by wall papers, gave such results that your Committee on Research concluded to pursue the subject further. This paper was prepared in accordance with the request of that committee.

On examining the apparatus used by Mr. Page it was apparent that the use of several reflecting surfaces introduced an error the gravity of which could not be estimated, therefore, in continuing the experiment it was decided to use a circular disk in the place of the box. At the suggestion of Mr. A. C. Humphreys, two photometer bars were arranged in parallel, 12 inches apart. One was 60 inches long and the other 72 inches. The shorter bar was used to compare the lights directly, the longer one to compare the reflections.

The bar for comparing the light reflected was made longer than the other one, so that the reflecting screens might be as nearly normal to the line of the bar as possible. The screens were placed normal to the line bisecting the angle between the 72-inch bar and the line drawn from the 72-inch bar and the line drawn from the center of the light to the center of the screen. When a flat flame burner was used it was so placed as to bisect the angle between the photometer disk and the reflecting screen. The reflecting screens were 12 inches in diameter and were so arranged as to be easily interchangeable and to be rotated around a vertical axis. As far as possible the tests were made on lights of equal illuminating power so as to reduce to a minimum any liability to error.

From Mr. Page's experiments it seemed that a slight difference in the color of the lights made a great difference in the amount absorbed by the screen and very much less of the light that had passed through an opal globe than that which had not so passed seemed to be absorbed by the wall paper. The experiments were carried out with the object of ascertaining whether such a difference really existed, and, if so, to ascertain its amount.

The method adopted was to compare the lights directly, then to compare the reflections. Afterwards an opal globe was put over one light and it was compared with the other unscreened. The reflections were then compared. After that the globe was changed to the other light and comparisons made as before. Any great degree of accuracy in comparing such small quantities of light as were reflected from the screens is out of the question, and the difference in the color of the lights added to the difficulties of reading closely. Great care was exercised to reduce all errors to as small a degree as possible, and the general result may be depended upon as being reasonably accurate.

As the time for making these experiments was limited, and as there was always a single object in view, no attempt was made to elaborate them. Several readings were taken for each result recorded, and the photometer screen and the reflecting screens were reversed. The opal globe was revolved and the mean of the readings taken. Several of the results seem to be at variance with what might have been expected, and others do not check. No attempt was made to ascertain the reason for this, as the time was short and there seemed enough data to demonstrate that no unusual effect is obtained by passing light through an opal globe, and that the light reflected is what may be expected when the color of the paper and the color of the lights are taken into consideration.

Paper No. 1.

Welsbach Light Tested against No. 7 Bray Slit Union.

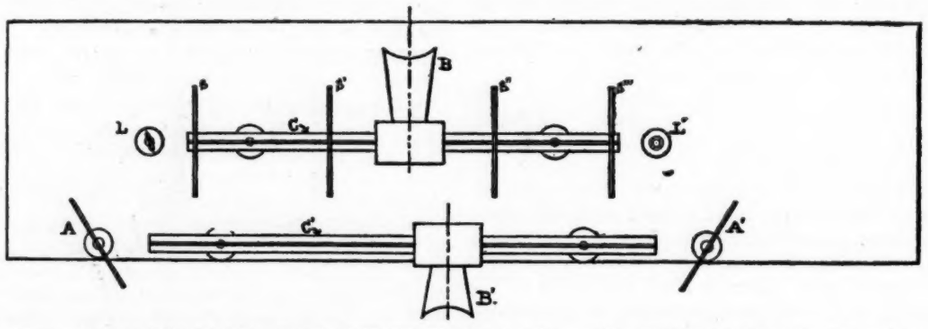
Direct.—Light from Welsbach = 1.4 × light from slit union.
Reflected.—Light reflected from Welsbach = 1.3 × light reflected from slit union.
Efficiency of Welsbach 94.3 per cent.

Slit Union Turned Down so as to Give a Flabby Flame.

Direct.—Light from Welsbach = 2.8 × light from slit union.
Reflected.—Light reflected from Welsbach = 2.45 × light reflected from slit union.
Efficiency of Welsbach compared to flat flame, 87.5 per cent.

Opal Globe over Welsbach.

Direct.—Light from slit union = 1.4 × light from Welsbach.
Loss due to globe 74.5 per cent.
Reflected.—Light reflected from slit union = 1.55 × light reflected from Welsbach.
Efficiency of Welsbach in opal globe compared to flat flame unscreened, 90.3 per cent.



A and *A'*, Reflecting Screens; *L* and *L'*, Lights; *S* and *S' S'' S'''*, Screens for Preventing Reflected Light from Reaching Photometer Disk; *B* and *B'*, Disk Boxes; *C* and *C'*, Photometer Bars.

PAPER No. 2.

No. 7 Bray Slit Union and Welsbach.

Direct.—Light from Welsbach=2.1×light from slit union.
Reflected.—Light reflected from Welsbach=1.85×light reflected from slit union.
Efficiency of Welsbach compared to flat flame 88.1 per cent.

Opal Globe over Welsbach.

Direct.—Light from slit union=1.85×light from Welsbach.
Loss due to globe 74.3 per cent.
Reflected.—Light reflected from slit union=2.25×light reflected from Welsbach.
Efficiency of Welsbach in opal globe compared to flat flame unscreened 82.2 per cent.

Globe over Slit Union.

Direct.—Light from Welsbach=7.15×light from slit union.
Loss due to globe 70.6 per cent.
Reflected.—Light reflected from Welsbach=6.0×light reflected from slit union.
Efficiency 84.0 per cent.

No. 7 and No. 3 Bray Slit Unions.

Direct.—Light from No. 3=1.025×light from No. 7.
Reflected.—Light reflected from No. 7=1.05×light reflected from No. 3.
Efficiency 92.9 per cent.

Globe over No. 3.

Direct.—Light from No. 7=3.55×light from No. 3.
Loss due to globe 75.3 per cent.
Reflected.—Light reflected from No. 7=3.55×light reflected from No. 3.
Comparative efficiency 100.

Globe over No. 7.

Direct.—Light from No. 3=3.35×light from No. 7.
Loss due to globe 69.4 per cent.
Reflected.—Light reflected from No. 3=3.40×light reflected from No. 7.
Efficiency 101.5 per cent.

PAPER No. 3.

No. 3 and No. 7 Bray Slit Unions.

Direct.—Lights equal.
Reflected.—Light reflected from No. 7=1.07×light reflected from No. 3.
Efficiency No. 3 93.5 per cent.

Globe over No. 3.

Direct.—Light from No. 7=3.3×light from No. 3.
Loss due to globe 69.7 per cent.
Reflected.—Light reflected from No. 7=3.3×light reflected from No. 3.
Efficiency 100 per cent.

Globe over No. 7.

Direct.—Light from No. 3=3.5×light from No. 7.
Loss due to globe 71.4 per cent.
Reflected.—Light reflected from No. 3=3.2×light reflected from No. 7.
Efficiency No. 3 91.4 per cent.

Welsbach and No. 7 Slit Union.

Direct.—Light from Welsbach=1.8×light from slit union.
Reflected.—Light reflected from Welsbach=1.7×light reflected from slit union.
Efficiency 94 per cent.

Globe over Welsbach.

Direct.—Light from slit union=2.15×light from Welsbach.
Loss due to globe 74.2 per cent.
Reflected.—Light reflected from slit union=2.30×light reflected from Welsbach.
Efficiency 93.5 per cent.

Globe over Slit Union.

Direct.—Light from Welsbach=5.3×light from slit union.
Loss due to globe 66 per cent.
Reflected.—Light reflected from Welsbach=4.7×light reflected from slit union.
Efficiency Welsbach 88.7 per cent.

PAPER USED BY MR. CARTER H. PAGE, JR., No. 4.

Welsbach and No. 7 Bray Slit Union.

Direct.—Light from Welsbach=1.8×light from slit union.
Reflected.—Light reflected from Welsbach=1.5×light reflected from slit union.
Efficiency 83.3 per cent.

Globe over Slit Union.

Direct.—Light from Welsbach=5.1×light from slit union.
Loss due to globe 64.7 per cent.
Reflected.—Light reflected from Welsbach=4.55×light reflected from slit union.
Efficiency 89.2 per cent.

Globe over Welsbach.

Direct.—Light from slit union=2.23×light from Welsbach.
Loss due to globe 75.1 per cent.
Reflected.—Light reflected from slit union=2.1×light reflected from Welsbach.
Efficiency 106 per cent.

No. 7 and No. 3 Bray Slit Unions.

Direct.—Light from No. 3=1.05×light from No. 7.
Reflected.—Light reflected from No. 3=1.05×light reflected from No. 7.
Efficiency 100 per cent.

Globe over No. 3.

Direct—Light from No. 7=3.25×light from No. 3.
Reflected.—Light reflected from No. 7=2 9×light reflected from No. 3.
Efficiency 112 per cent.

Globe over No. 7.

Direct.—Light from No. 3=3.55×light from No. 7.
Loss due to globe 70.4 per cent.
Reflected.—Light reflected from No. 3=3.3×light reflected from No. 7.
Efficiency 93 per cent.

Proportion of unscreened Welsbach light reflected, when compared with light reflected from

No. 7, stiff flame, Paper No. 1	94.3 per cent.
No. 7, flabby flame, Paper No. 1	87.5 "
No. 7, a stiff flame, Paper No. 2	88.1 "
No. 7, stiff flame and globe, Paper No. 2	84.0 "
No 7, stiff flame, Paper No. 3	94.4 "
No. 7, stiff flame and globe, Paper No. 3	88.7 "
No. 7, stiff flame, Paper No. 4	83.3 "
No. 7, stiff flame and globe, Paper No. 4	89.2 "

Welsbach in opal globe compared with

No. 7, Bray slit union,	flabby flame, Paper No. 1.....	90.3	per cent.
No. 7, " "	stiff flame, Paper No. 2	82.2	"
No. 7, " "	stiff flame, Paper No. 3.....	93.5	"
No. 7, " "	stiff flame, Paper No. 4.....	106.0	"

No. 3 Bray slit union compared with

No. 7, Bray slit union,	Paper No. 2.....	92.9	per cent.
No. 7, " "	and globe, Paper No. 2.....	101.5	"
No. 7, " "	Paper No. 3.....	93.5	"
No. 7, " "	and globe, Paper No. 3.....	91.4	"
No. 7, " "	Paper No. 4.....	100.0	"
No. 7, " "	and globe, Paper No. 4.....	93.0	"

No. 3, Bray slit union, screened with opal globe, compared with

No. 7, Bray slit union,	Paper No. 2.....	100.0	per cent.
No. 7, " "	Paper No. 3.....	100.0	"
No. 7, " "	Paper No. 4.....	112.0	"

Average loss due to globe.

No. 7	68.8	per cent.
No. 3.....	71.5	"
Welsbach	74.5	"

Per cent. efficiency compared with No. 7 burner burning with stiff flame.

	Opal Globe.	Unscreened.
Paper No. 1, Welsbach.....		94.3
Paper No. 2, Welsbach.....	84.0	88.1
Welsbach, with opal globe.....		82.2
No. 3 slit union....	101.5	92.9
No. 3 slit union, with opal globe		100.0
Paper No. 3, Welsbach.....	88.7	94.4
Welsbach, with opal globe.....		93.5
No. 3 slit union.....	91.4	93.5
No. 3 slit union, with opal globe		100.0
Paper No. 4, Welsbach.....	89.2	83.3
Welsbach, with opal globe.....		106.0
No. 3 slit union.....	93.0	100.0
No. 3 slit union, with opal globe		112.0

Discussion.

In opening the discussion on Mr. Miller's paper Mr. C. H. Page read the following: I have read Mr. Miller's paper very carefully, and am gratified to find that, notwithstanding his remarks at our meeting last year, that I had apparently proved that white paper was not white, he practically substantiates by his experiments what I then endeavored to show, namely, that illuminating effects are not ordinarily measured by the photometer. In the second paragraph of his paper Mr. Miller states that the method I employed "introduced an error, the gravity of which could not be estimated." From my experience in my original investigations I hope Mr. Miller provided his apparatus with some adjustment for determining the actual angle at which the reflecting screens were placed with certainty, else I would be inclined to question the comparative results; for I found that a small deviation from a given angle produced a remarkable variation in the results obtained. It was partially for this reason that I abandoned the single reflecting surface. The principal reason for adopting the box method was to approximate as closely as possible the conditions actually existing in an apartment. I think Mr. Miller's paper would have been more justly termed "Some experiments on surface reflection," for there are no conditions approximating an interior in his researches. I wish to call attention to the experiments with paper No. 1; that is, that the stiff flame of a No. 7 Bray special union does not give as much reflected light as the flabby flame of the same burner, with I presume the same quantity of gas. The same result is shown in paper No. 2, when a No. 3 Bray and a No. 7 Bray are compared. Paper No. 3 shows the same result. Paper No. 4, which is a piece off the same roll I used last year, and which Mr. Miller said I only proved was not white, gives the same reflected value for the No. 3 and the No. 7 Bray; but gives a lower reflected value, when a No. 7 Bray is compared with a Welsbach lamp, than any of the other samples. I would like Mr. Miller to explain why, in view of the above results, the reflected efficiency of the No. 7 and the No. 3 Bray burners is identical in this case; but that of the Welsbach is less by 4.7 per cent. than any of the other papers. I feel that both Mr. Miller and Mr. Humphreys have misunderstood the drift of my experiments last year. I certainly did not claim that an opal globe would increase the light transmitted from any source. I proposed to show that illuminating effect was largely dependent upon the color and the size of source of light. This I believe has not been proved false by Mr. Miller's experiments. The bar photometer is beyond a doubt the only correct way of measuring candle power; but I am sure it does not measure illuminating effect, inasmuch as I have shown by my experiments, and Mr. Miller has apparently substantiated my results, that more light is reflected with a flabby flame than with a stiff flame of the same candle power.

Mr. A. C. Humphreys understood that Mr. Miller had taken different colored flames and papers to illustrate the different effects obtained through direct and reflected lights; also the effect of using an opal globe; but perhaps a more satisfactory result would have been reached if the experiments had been commenced with illumination on the direct bar, if he might so say. He did not know that he was on record anywhere as having said that illuminating effect could be measured by a bar photometer. He did assert, however, that that instrument was the most accurate one at their command for estimating lighting values.

The discussion was carried on at considerably greater length, Secretary Forstall, and Messrs. Page, Searle and Miller participating therein. At the conclusion of the debate (on motion of Mr. Beal), a vote of thanks was passed to Mr. Miller.

THE QUESTION BOX

was then re-opened, and the Secretary read the following query:

"Is it advantageous or beneficial for gas companies to encourage the lighting of streets with self-generators or naphtha burners beyond their mains?"

Mr. A. S. Miller said that that question had been considered by a gas company with the practices of which he was familiar. In the outlying districts, where their mains did not extend, it was finally determined to make a contract with a naphtha lighting concern, the latter to perform the work in the isolated sections, under an agreement that when the gas mains were extended to the naphtha lighted territory the gas company was to take over the business. The scheme worked well, in that it enabled the gas company to retain much street lighting that otherwise would have gone to the electric lighting people. He thought the question should be answered in the affirmative.

Mr. A. C. Humphreys gave an unqualified indorsement of the opinion advanced by Mr. Miller. He also felt that the outdoor Welsbach lamp was bound to make a sensible and broad impress upon the street-lighting methods of the country. Indeed, it had already done so.

The President said that as the subject was of such importance he would call upon Mr. D. J. Prendergast, of the Welsbach Street Lighting Company of America, to explain the methods under which that Company proposed to work.

Mr. D. J. Prendergast thanked the President for the invitation to spread before the Association the purposes of the Welsbach Street Lighting Company, of America. He then spoke at length as to the plans and methods of the Company. The latter was controlled by capitalists who had been engaged in the lighting of streets by means of naphtha burners for many years. The Company now had control of the Welsbach street lighting lamp, and it proposed to work in complete harmony with the views of existing gas companies. The latter were those who could dictate the terms; the Welsbach Street Lighting Company would carry them out. The Company's representatives would be only too glad at any time to confer with the representatives of the gas companies; and he was sure his Company was in control of an agent that would bring back to the gas companies much of the street lighting which had been lost to them by the competition of the electric promoters.

The Secretary then read the following questions, which it was agreed upon could be profitably discussed in conjunction:

"What is the best continuous yield in candle power per gallon obtained from an improved Lowe double-superheater apparatus, using gas oil of 40° gravity?"

"Does not the candle power of the gas make a difference in these results per gallon? That is, cannot a higher yield per gallon be obtained when making a 22-candle gas than when making a 30-candle gas?"

The President announced that at his instance Mr. A. B. Slater, Jr., of Providence, R. I., had forwarded a written reply to the above questions. The Secretary then read Mr. Slater's communication, as follows:

"In regard to the questions which you sent me, I would say in regard to the 'best continuous yield in candles per gallon of 40° oil in the Lowe double apparatus,' that I do not feel in position to answer that question.

"As for the other question I have found that, when making a gas from 18 to 26 candles, the oil efficiency does not vary much. In going above, say, 26 candles, the amount of oil required for each candle increases, roughly, in direct proportion to the candle power obtained. In carbureting the gas, the first 10 candles takes considerable oil, but to double the candle power (to 20) does not by any means require double the amount of oil. In other words, as we go down from, say, 18 candles the oil efficiency decreases rapidly, and as we go above 25 candles the oil efficiency again decreases, the decrease in efficiency growing more rapid as the candle power goes up."

The next question was:

"In a retort house with double set of benches, what are the relative advantages of having the benches back to back with two operating floors, one on either side of the house, or benches facing each other, having one operating floor in middle of house?"

Mr. W. A. Miller thought that the men would be subjected to much less heat in a house where the retorts were operated from both sides than when the retorts were operated only from the center.

Mr. A. E. Forstall said an advantage of double sets of benches, back-to-back, was that there were but two radiating surfaces for loss of heat, instead of four, as in the other place. Heavier back walls would obviate the trouble, but such construction meant increased cost of building. Mr. Miller's point was a very grave one, as Mr. Forstall knew from actual experience.

The next question:

"Is there any decision of the courts fixing the liability for damages to gas or water mains from electrolysis upon the trolley companies causing the damage?"

Mr. Ramsdell thought such a case had been tried and decided by the Massachusetts courts, but he could not say with certainty that that was the fact.

The President announced that a "short topic" for discussion on the subject of

LEAKAGE

had been forwarded by Mr. J. M. Rusby, of Jersey City, N. J. On motion of Mr. A. C. Humphreys, the Secretary read the Rusby topic, as follows:

The writer has been doing during the past season a little work in the reducing of leakage. The following brief remarks give a very rough outline of methods and experience.

The method adopted for determining the location and amount of leakage in mains and services must vary in different cities and different parts of the same city. The one which in the writer's case is largely practicable, and has been adopted, is to isolate small portions of main, shutting off all consumers' meters upon them, and make an actual test, through a small meter, of the leakage. This method, while apparently tedious and expensive, has the very great advantage of giving absolute information as to the condition of all piping up to the consumers' meters. Also, owing to the fact that sound piping will be accurately located and its examination avoided, the method is neither so slow nor so costly as appears at first sight.

The isolating of these districts may be done in a number of ways; by valves, by permanent appliances in main for water sealing, or by bags. The latter is the method which has thus far been used by the writer almost entirely. The method of use of bags is very simple. A hole is tapped into the main, and through this are inserted two bags, one upon each side of the hole, which are then inflated. A short wrought iron nipple is screwed into the hole. Water is then poured into the main, between the bags, through the nipple, and stands in the nipple a little above top of main. In order that the bags may fit close against the main, and be watertight, it is well to wash off the interior of the pipe with water before inserting the bags. If small leakage exists, make a gruel of oatmeal, which, being viscous, will not leak readlly; or a few drops of machine oil, poured in before the water, will rise and stop up small crevices. But few cases will be found where a perfect seal cannot be made. We prefer white rubber bags to the black, they being less easily injured by gas or condensation in the main.

The length of main included in each test will, of course, depend upon the number of meters to be shut off, and upon possibly other circumstances. Our districts average about half a mile in length. At various points throughout this district also, the main is dug up and tapped. After testing the entire district bags are inserted at the intermediate openings, and one portion after another of the district is cut off, the reduction in rate of passage of gas by meters being noted. Thus, with one setting of the test meter the badly leaking portions of mains can be closely located.

The cost of testing as above will average, for block or other common pavement, about $1.50 per opening in main, this covering labor and material. Valves should probably be installed in at least smaller sizes of mains for a total cost of $10 or $11 each. If the mains prove to not require frequent examination, the bags will be found more economical than the valves. The circumstances of each particular case will determine the best method. Bags will, however, always be found of value for at least occasional use.

After locating a section of main and pipe which is very leaky, comes the close examination of services and mains for individual leaks. Barring is the chief means used by us. A bar is used which is 5 feet long, 1¼ inches in diameter, and tapering gradually; it is finished with a square head, upon which is fitted a handle 30 inches long, by which the bar is twisted and lifted. Barring can be successfully done through asphalt pavement, even on concrete foundation, by using, before the above long bar, a very short and stout one to start the hole through the pavement. It is important that not only shall the bar be put down right over the main but over the joint as well. Therefore, dig up the main at each end of a block, locate the line of main, and also locate the position of two joints; from these measure off and mark on pavement the position of each joint on line. It is our system to permanently locate two or three joints in each block by marks upon the curbstones; this will render entirely unnecessary the future digging up of main to locate joint ahead of barring. We also keep accurate sketches showing locations of specials, distance of main from curb, etc. The connection of services with mains is also barred over. An inspection of services in house cellars will give valuable information as to their age and probable condition in street. The service may be dug up at main, and if it shows signs of any considerable age it may be worth while to cut it, attach a pressure gauge, blow 3 or 4 inches pressure upon it, and note its soundness. It is well, while mains are being examined and repaired, to make the work thorough; renew, for instance, any service that is likely to give trouble within the next three or four years.

The work of barring and testing mains and services demands care and patience. In some soils barring must be done very close to a leak or it will not be discovered. In such cases it may be well to bar midway between main joints as well as at joints. In some cases, nothing will serve but continued sub-dividing of lines of main, testing by meter or gauge, and after this liberal digging. The great advantage of testing is that, the amount of leakage being definitely shown, one is not apt to abandon repair until every bit of trouble is found and corrected.

The leakage existing at our own plant is found to be very largely in street lamps and house services. Certain portions of our plant are very old indeed. Some old services not in use have been lost sight of, never cut off at main, and are now among our most prodigal consumers. Other services, old, but in use and apparently sound, are found corroded at curb or elsewhere.

It is our present system to connect services to mains by a double elbow, forming a swing joint; this gives flexibility to the service joint above main. In former years this practice did not exist, and we find very many of the old style connections cracked or broken off. Pipes which in laying have been sprung into place and left with a strain upon them are pretty sure to give trouble by breakage, sooner or later, under jar or partial corrosion. Exposed, deeply cut threads also give trouble, being easily liable to breakage or corrosion, as the metal is thin and soft. We now carefully protect all exposed threads with a wrapping of cloth and white lead. Shallow mains in heavily traveled streets are a source of trouble. Crosses and tees at street intersections are also especially liable to show leakage at joints.

We keep a card record of all mains repaired, giving detail of cause of leakage. We also keep a card record of every service examined or repaired, with a note as to its condition. Reference to these will undoubtedly save much trouble in locating future leaks. We keep a memorandum book containing information as to places likely to give future trouble, as, for instance, a stretch of shallow, small or old main, a place where joints are disturbed by heavy traffic, a section of city containing many old services, etc. We also keep a sketch book containing diagrams of our test districts, with records of various tests made upon each.

In addition to the foregoing remarks, which chiefly concern the correcting of existing leakage, it may be worth while to add one or two hints as to means for its avoidance, etc., although they will probably be largely unnecessary to you.

All our service pipe now laid is coated with service mixture. For method and composition, see paper[1] of Mr. A. C. Humphreys, read

1. See JOURNAL, Dec. 7, 1896, p. 887.

before this Association last year. In addition to being coated at storeroom, another coat is applied to the pipe after it is in position in trench. In bad soils, or under trolley tracks, the pipe is further wrapped with a layer of cheap cloth and again smeared with a very heavy coat of melted asphalt, slightly diluted with thin tar; or, in some cases, is laid in a trough and is covered with asphalt.

Our mains are laid almost entirely with cement joints. Main pipe is hammer-tested and carefully inspected before laying. After laying, and before being covered, it is tested under gauge, about 8 inches water pressure being used.

The station meter should, of course, receive special attention. Its water level should be carefully established. In proving it to fix the water level, its drum should be made absolutely tight, at least temporarily. Small leaks which, in the regular operation of the meter, may be insignificant, may, at the slow rate of passage of gas in proving, introduce serious error and render worthless the determination of water level. After the water level has been fixed, the meter should be occasionally proven to check its tightness. Tests at two different rates (say 600 feet per hour and 100 feet per hour) will clearly show tightness; if the amounts passed by proving meter differ, leakage exists. By reading the proving meter, for fractions of the rotation of the station meter drum, and comparing these readings, leakage can be still more clearly shown and approximately located. By removing the manholes of meter case above the drum, and passing ropes around the latter, thus holding it at any desired position, and applying a moderate pressure (not to exceed the safe working "head"), the position and magnitude of leaks can be ascertained; or, pressure can be applied to the various compartments of drum, through the plugs regularly provided, and the same information obtained. By these means the "seal" upon meter compartments can be checked if it is uncertain. Every station meter is supposed, of course, to be provided with a water overflow, in which the water is subjected to the pressure of gas at meter *inlet*, which, if kept in order, insures constant water level from hour to hour and day to day. The meter should run with uniform back pressure. There is nobody, it is hoped, who fails to correct the monthly station meter reading for temperature, as this is liable to occasion much discrepancy in gas. A thermometer thrust into the meter outlet and read frequently day and night, these readings being footed up and averaged for the month, gives an average temperature which, while not quite correct for several reasons, may be made pretty nearly right. Tables of correcting factors, by which to multiply the station meter reading, will be found in numerous places; they are given in "Newbigging's Handbook," 1885, pages 252 and 253; also in "King's Treatise," page 261.

Slow registration of consumers' meters is especially bad, because it means loss of gas at selling price instead of at holder cost. We remove for proving and repair, if latter be needed, small sizes every three years, and large ones every year. In addition to this, every meter removed for incidental causes, no matter what its previous period of service, is given proof also.

We succeed in keeping our meters in a condition of nearly correct registration.

Although unavoidable, difference of pressure in station and consumers' meters occasions some discrepancy. A pressure of 6 inches of water in station meter and of 2 inches in the consumers' meters means a difference in registration of about 1 per cent., which is in direction of less apparent leakage.

Condensation of illuminants and water vapor also produce some discrepancy. The former influence should be trifling. As to water vapor, gas measured at the station meter at 60° F. and 30 inches barometer contains about 1¼ per cent. by volume of water vapor. At 32° it contains a little more than one-half per cent. In winter, therefore, if gas be cooled in mains to 32°, and if the vapor condensed be actually thrown down, the gas on warming up at the consumers' premises will still be short in registration by this difference in per cent.

To the important matter of effect upon registration of high and low temperatures at the consumer's meter we can only refer. We hoped to present at least a *little* data upon this point, but have not had time to collect it.

Discussion.

The President in inviting discussion regretted that Mr. Rusby was not present to take part in the debate, for many new ideas had been presented in clear manner by him.

Mr. A. C. Humphreys said the only point that Mr. Rusby seemingly failed to note in connection with the complex and many-sided subject of leakage was holder inspection; for he thought holders, and especially the crowns thereof, often contributed their quota to the leakage account as a whole.

Mr. W. R. Beal said they had had much trouble in their district through disjointed mains and services, which trouble, however, was largely chargeable to the municipal improvements that were being made by the authorities north of the Harlem river. Street grades were being changed, sewers built and pavements laid, all of which disturbed their distributing system. They watched the system closely, however, and had succeeded fairly well in keeping the leakage account down to something like reasonable figures.

Mr. E. H. Jenkins said he had much discomforting experience with leakage at Covington, Ky., not a little of which loss was directly attributable to electrolytic action. He exhibited a section of riser pipe in a lamp post that had been affected in a peculiar way by the diversion of current from a trolley line wire. The current melted the riser and set fire to the gas. He also exhibited a piece cut out of a cast iron main that had been in use for 30 years. The pipe was completely honeycombed. Mr. Jenkins then described the system in use by him at Covington for detecting leaks in street mains, and declared that it was his intention to give a thorough test to what is known as the Bouvier method (well known in France and Belgium) for testing the soundness of a distributing system.

Mr. Searle said he believed in isolation as against barring.

Mr. A. C. Humphreys thought it should be borne in mind that isolation would not be of much value in cities where heavy leakage existed, which state of affairs unfortunately could be found in too many places. Isolation would be excellent to keep in sound order a main system that had been put in shape through thorough inspection and repairing.

Mr. Prichard formerly was a believer in the isolation of a distributing system, to correct defects therein. Now, however, he thought it best to follow the plan of barring.

The thanks of the Association, on motion of Mr. A. C. Humphreys, were voted to Mr. Rusby.

VOTES OF THANKS.

On motion of Mr. Ramsdell a vote of thanks was tendered to President Nettleton for the able manner in which he had directed the proceedings of the meeting. Similar acknowledgements of the Association's indebtedness to Secretary Forstall, to the Committee of Arrangements, and to the Old Dominion Steamship Company, were adopted. The Association then ordered a recess, until the termination of the excursion set for the following day, when it was agreed the meeting would stand permanently adjourned.

[Prepared for the JOURNAL.]

Cyanides in Gas Manufacture.

[By MR. HERMAN POOLE, F.C.S.]

One of the leading and most interesting questions now before the gas manufacturer is that of cyanogen and its compounds, the cyanides, ferrocyanides and sulphocyanides. Not only has attention been drawn to this subject by the chemist, but also by the manufacturer and user of these chemicals. A few years ago the question of residuals was not considered worth talking about; only fanatics and hobby-riders would think of them, much less give them an earnest consideration. Then coke was not considered a residual, because there had been a sale for it from the beginning of the gas industry, and even before such date. Gradually it became known that tar was actually worth something, then the ammoniacal liquor nuisance became valuable, and hence ceased to be a nuisance. At this stage of the history residuals became a common word, and soon was applied to all, solid or liquid. A market having been found for the coke, ammonia and tar, the next one to take up was cyanogen and its compounds, and now these become important matters. Right here it may be interesting to consider the order in which these residuals were utilized. First, the coke from the retort; next, the tar from the hydraulic main and condensers; then the ammoniacal liquor from the condensers and scrubbers; and now, the sulphur and cyanides of the purifying box. We will soon have to put on something beyond the purifier and make another bye-product.

The quantity of cyanides from gas now wasted in the world is simply enormous, even in spite of the modern attempts at recovery, and such a waste is a disgrace to our so-called advancement in science and art. True, the proportion of nitrogen in coal is small, not often exceeding 1 per cent., and very seldom more than 2 per cent.; yet, with only one-fifth of this being converted into cyanogen, still, considering the millions of tons of coal used, we easily see that thousands of tons of cyanides and thousands of dollars are yearly cast away. In 1895, Germany exported a million dollars' worth of cyanide of potassium,

most of it from gas sponge, and from this we can get an idea of how much we should make. Of course, as is usual with new countries, we have been slow to appreciate the enormity of the crime of throwing away valuable material. We are doing it all the time and in nearly all industries, so we are accustomed to it. But we are gradually changing our ideas.

In discussing this question, one of the first queries that comes up is how they are formed. This question has been asked and answered repeatedly, but, I am sorry to say, not always in the same way. The amount of actual experimental work performed to elucidate this point is very little; occasionally someone gives a small contribution towards the solution, but no regular, systematic, continued research has ever been done. It cannot be settled by one day's experiments, nor by tentative work in the laboratory with pure materials. The gas manager cannot find the time, if he would; the ordinary chemist cannot do it, if he had the time, and so we may still expect occasional sporadic efforts, and nothing accomplished of a satisfactory nature.

Prominent among the known facts in this connection is the one that if ammonia gas is passed slowly over incandescent carbon, more or less hydrocyanic acid and ammonium cyanide with hydrogen are produced.

$$C + NH_3 = CNH + H_2; \text{ or,}$$
$$C + 2NH_3 = CN, NH_4 + H_2.$$

The slower the flow of the gas the greater the quantity of cyanogen compounds formed. Care must be taken not to heat the resulting products too high, or partial dissociation will take place with resolution to the elementary forms. In presence of a large excess of hydrogen, or a moderate excess with increase of temperature, the product is hydrocyanic acid alone, the ammonium salt being prevented from forming by the heat, or being decomposed, if formed.

If, instead of using carbon in the solid state, gaseous carbon combined with oxygen, as in carbonic oxide, be mixed with the ammonia gas, and this mixture heated, the hydrocyanic acid or ammonium cyanide will be produced as before, according to the proportion of the gases; and usually they are found together in variable quantities.

$$CO + NH_3 = CNH + H_2O; \text{ or}$$
$$CO + 2NH_3 = CN, NH_4 + H_2O.$$

Of course, this action is dependent on the quantity of surface exposed to the action of the heat, and hence the action is more complete when the gases are passed through a heated tube filled with fragments of porcelain, earthenware, silica, or other inert refractory substance.

If to the preceding products sulphur be added, or if the ammonia gas be mixed with gaseous sulphur, as in carbon disulphide, ammonium sulphocyanide is then produced,

$$CS_2 + 2NH_3 = CNS, NH_4 + H_2S;$$

and this will remain permanent under conditions which would decompose the others.

In order to trace the connection of the formulæ and their relation to each other, they are given together:

$$C + NH_3 = CNH + H_2, \text{ or}$$
$$C + 2NH_3 = CN, NH_4 + H_2;$$
$$CO + NH_3 = CNH + H_2O, \text{ or}$$
$$CO + 2NH_3 = CN, NH_4 + H_2O; \text{ and}$$
$$CS_2 + 2NH_3 = CNS, NH_4 + H_2S.$$

While performing these experiments, and at easily attainable temperatures, three laws are shown:

1. The higher the temperature and the slower the flow of gas, the greater the yield.

2. The single reactions are never complete, but always occur together and in variable proportions.

3. If the reactions occur in presence of sulphur it will always enter into the combination produced.

If the reactions are carried on in the presence of a fixed alkali or alkaline earth the proportionate yield is much greater. These seem to have the property of fixing or solidifying the cyanogen compounds as formed, and thus partially withdrawing them from further action.

It is not necessary that the ammonia should be in the state of free ammonia; ammonium chloride, carbonate, and especially sulphide, will do as well, only, in this case, the secondary reactions will be more complicated.

A very neat way of trying this experiment, and one easily performed, is to cause some water gas to bubble through ammonia water and then burn the mixture in an ordinary burner. The carbonic oxide and the ammonia will thus exist in the gas, and on burning it and causing the flame to impinge on the surface of a tumbler of weak potash solution, potassium cyanide will be produced and can be detected in the liquor. If distilled water be used instead of the potash solution, ammonium cyanide will be formed. If the temperature be allowed to become high enough, as with a Bunsen burner, no cyanide is formed, showing that although heat is necessary too much destroys its compounds.

Stress is put on these preliminary fundamental reactions, because they are now old and well-established, having been proved in 1841 and accepted since. A thorough understanding or appreciation of this is necessary, as the conditions are very similar to those existing in the retort.

Here may be found the incandescent carbon, the carbonic oxide, the ammonia, the carbon disulphide and, probably, other elements which have an influence on the cyanogen formation. It has been shown that the reactions take place more readily in presence of coal gas than with pure substances, and that in such mixtures the formation of hydrocyanic acid takes place at a lower temperature. The quantity of free hydrogen in the crude gas has a modifying effect, since a large percentage is always accompanied by a small percentage of ammonium cyanide; and here comes up the question whether the small cyanide percentage is actually due to the presence of hydrogen *per se*, or is it due to the high temperature of the retort in which such large percentage of hydrogen was produced? This seems to be the only way to reconcile results so diametrically opposite as those obtained by such reputable experimenters as Bloxam and Perthuis.

Bearing on this are the experiments of Bergmann, in which he found, in a mixture of carbonic oxide and ammonia, that 4 per cent. of the nitrogen was converted into cyanogen at 800° C., 24 per cent. at 1,000° C., and that when illuminating gas was added to the mixture the proportion of nitrogen changed increased to 60 per cent.

The sulphur existing in the coal is probably all combined with iron in the form of iron pyrites, FeS_2, possibly Fe_2S_4. During the distillation this sulphur combines initially with carbon to form carbon disulphide, or, with hydrogen, to form sulphureted hydrogen, H_2S. These compounds then pass on or enter into further reactions; but what of the iron? Part of the sulphur combines to form sulphocyanides; does the iron enter combination as ferrocyanide? It seems not. The iron cyanogen compounds easily decompose at a red heat, as is well-known and made use of in the common method of making potassium cyanide from potassic ferrocyanide. Hence it is doubtful if the compound is formed at all; and, if formed, it could not maintain its existence. At any rate, but few if any authentic cases are on record showing ferrocyanide in crude gas as it leaves the retort or hydraulic main.

Right here on this subject of ferrocyanide in crude gas, let me request those of the managers who are interested to make a few tests to ascertain some facts on the subject. They can be easily performed, and, although with old methods, will give good results. There are certain questions which must be solved at the works, and on the gas as made at the works. A few tests made occasionally will help, and especially if they can all be collated and arranged so as to classify the results.

Provide three flasks with the ordinary glass tube and rubber connections for the stoppers. Have a little wooden stand made to hold them and to carry them around in.

For cyanides in the gas use a flask containing a mixture of ferrous sulphate and caustic potassa or soda. Pass the gas through it, then warm it slightly and acidify with hydrochloric acid. A blue precipitate indicates cyanogen in the gas.

For ferrocyanides use a flask containing a dilute solution of ferric chloride. Pass the gas through this, and a blue precipitate will show ferrocyanide.

For sulphocyanides use the third flask, containing a weak solution of ferric chloride. A blood-red coloration shows the presence of sulphocyanogen. This color is not affected by hydrochloric acid, but is destroyed by nitric acid.

These tests can be made easily, and will take very little time. Let the gas bubble through for 10 minutes or half an hour, and attend to something else meanwhile.

After the gas leaves the retort it passes through the hydraulic main, the condensers, and the scrubbers or washers, without undergoing much change in composition in the portions that are now under consideration.

As a side remark, it may be said, the absence of ammonium cyanide in the ammonical liquor is worthy of mention. Ferrocyanide and sulphocyanide are found; but why no cyanide? The most plausible explanation seems to be that the hydrocyanic acid is very weak under the conditions, and that the carbonic and other acids force it out from its ammonium combination. Other influences besides simple chemical affinity come in here, and it is probable also that the heat of formation, having

split up or prevented the formation, the proper conditions for its decomposing the compounds then formed do not subsequently exist. It is well known also that a slight variation in temperature may cause an entire rearrangement of the molecular composition of a mixture; and this is more apt to occur the more complex the body or mixture.

When the gas reaches the purifiers, then commences that series of changes and decompositions about which so much has been written, and so little actual knowledge gained. Once in a while someone will experiment with a purifier box and obtain results that count; but unfortunately most of the experiments are made on pure oxide, pure sulphureted hydrogen, or else illuminating gas so saturated with sulphur that it might as well be all sulphur, and we are coolly informed that these conditions duplicate those of the purifying box. Perhaps I used the word duplicate incorrectly, and should say quadruplicate, as the impurity is increased fully up to that amount. As long as this goes on we shall keep having explanations that do not explain. To ascertain what is going on in a manufacturing process involving many elements and impurities, we must experiment on the substances used as they exist, with all the crudities of the manufacture, and not as we would like to have them. Anything else is mere child's play, and usually leads to incorrect deductions.

The most trustworthy experiments yet made show that the cyanogen unites with the iron in the purifier and forms ferrous cyanide. This ferrous cyanide is usually described as of a grayish-blue color, rapidly becoming blue from the absorption of oxygen and the formation of Prussian blue. The color is all right; but is it due entirely to ferrous cyanide? This is doubtful, since pure ferrous cyanide is of a yellowish-orange tint, with a slight gray at times. A slight oxidation turns it bluish-gray—a full oxidation turns it blue. It looks as though the cyanide formed is not true ferrous cyanide, according to the equation—

$$FeO + 2NH_4CN = Fe(CN)_2 + (NH_4)_2O,$$

but something else. What is it?

The iron in the purifying box is there as a hydrated sesquioxide, $Fe_2O_3(H_2O)_n$, and yet the first part of the above formula calls, not for sesquioxide, but protoxide. Where has the oxygen gone, and what made it drop out? We are not told. It looks as though the formula maker could not prove his theory with the Fe_2O_3, and so changed it to FeO. which worked all right.

Does not this formula account for the facts as well if not better?

$$Fe_2O_3 + 4HCN = 2Fe(CN)_2 + 2H_2O + O,$$

the probable formula, or, alternately,

$$Fe_2O_3 + 4NH_4CN = 2Fe(CN)_2 + 2(NH)_2O + O.$$

That is, the iron sesquioxide and the hydrocyanic acid form ferrous cyanide, water and oxygen, and then the extra oxygen unites with some of the cyanide to form Prussian blue, according to the accepted formula:

$$\underset{\text{Ferrous Cyanide.}}{9Fe(CN)_2} + 3O = Fe_2O_3 + \underset{\text{Prussian Blue.}}{Fe_7(CN)_{18}}.$$

This explains the actual condition of affairs. It takes the sesquioxide and not the protoxide; it produces a mixture of ferrous cyanide and Prussian blue, which would answer the description given, which description pure ferrous cyanide does not satisfy.

If ammonium cyanide occurs in excess we would have ammonium ferrocyanide formed.

$$Fe(CN)_2 + 4NH_4CN = Fe(CN_6)(NH_4)_4.$$

That ferrocyanogen exists in the sponge may be easily ascertained by treatment with with water and testing the solution. If found it will be ammonium ferrocyanide, as that is the only soluble ferrocyanide possible under the circumstances (of course, potash, soda, lime, etc., are supposed absent). After a thorough washing of the mass, treat it with a weak caustic liquor (potassa or soda), and this liquor will show the cyanide due to the Prussian blue existing as such in the material.

The cyanogen may also become fixed in the iron mass through the agency of ferrous sulphide, which could be formed from the iron sesquioxide and the sulphureted hydrogen. This undoubtedly accounts for a portion of it; but how much cannot be said at present.

$$Fe_2O_3 + 2H_2S = FeS + 2H_2O + O \text{ ; and then,}$$
$$FeS + 2HCN = Fe(CN)_2 + H_2S, \text{ or}$$
$$FeS + 2NH_4CN = Fe(CN)_2 + (NH_4)_2S.$$

If ammonium cyanide be in excess we would have, as before, the formation of ammonium ferrocyanide.

That these reactions take place is shown by the fact that, after the formation of a quantity of FeS, and the subsequent thorough removal of the extra sulphureted hydrogen by an inert gas, passing a gas containing cyanogen, causes the reappearance of sulphur at the outlet. Here also we see further that it is possible to find sulphureted hydrogen in gas after traversing an old purifier, although it contained none when it entered.

We have spoken of the occurrence of sulphocyanogen in the crude gas and how it is probably formed. The presence of this form of cyanogen in the gas may account for its presence in the purifying material, but does not account for all, as it may be formed, and quite easily, in the box.

A current of gas containing cyanogen, either in a simple or compound form, will have a tendency, on meeting sulphur, to decompose and unite with with it, especially if it is free or in loosely combined condition, and form a sulphocyanide. This reaction takes place under a slight increase in temperature, and more readily in the box than in a small test sample in the laboratory. That we do have a slight increase of heat is known, and that under the very complicated conditions of heat, moisture, crude gas, sulphur, ammonia, iron oxide, etc., the formation of sulphocyanogen compounds occurs according to the universal law of combination in virtue of which the most stable compounds in mixtures are formed and exist. Sulphocyanides are the most permanent and stable compounds in this case, and hence are always formed.

The conditions in the purifier are exactly the same as those cited. The gas is there carrying the variable small proportion of cyanogen compounds; the sulphur is there as carbon disulphide, hydrogen sulphide or free sulphur, ammonia is there, we have more or less moisture, and we have some heat. Then all the elements needed are present and active.

The presence of sulphocyanide in the crude gas has been denied, and experiments shown to prove its absence, but one positive experiment proves more than a dozen negatives, and the fact that it has been found shows the possibility, even if it is not produced in every case. In the cases where its absence was shown, its presence in the purifier was noted, substantiating the statement that the purifier is the principal producer of the sulphocyanogen compounds. There is a great need of more definite experimental results on this point, and it is to be hoped that ere long they will be taken up and followed till the question is satisfactorily settled.

Sulphocyanides are more permanent than either cyanides or ferrocyanides, so that we may expect their formation whenever possible.

Probably some sulphocyanogen is derived from the interaction of carbon disulphide and ammonia, according to the formula given above, or from carbon disulphide and ammonium sulphide, according to the formula—

$$CS_2 + (NH_4)_2S = CNSNH_4 + H_2S;$$

but this cannot be a large quantity in comparison with that produced as above.

It is evident that if we wish to keep down the percentage of sulphocyanides we must keep low the quantity of ammonia passing into the box. Of course, under the present conditions we cannot keep it all out, but we should try to keep it as much as possible where it belongs, and where it can be turned into money, namely, in the ammoniacal liquor.

In closing, it will be well to summarize a few of the facts stated above, so as to present them more sharply and connectedly.

1. Cyanogen exists in crude gas as hydrocyanic acid, ammonium cyanide, or sulphur cyanide.
2. Ferrocyanides do not exist in crude gas.
3. Prussian blue is formed in the purifier under ordinary circumstances only in small quantities; on the admission of air it is formed from oxidation of the ferrous cyanide.
4. Sulphureted hydrogen may be taken up by a gas in passing through an old purifier.
5. Sulphocyanides may form in the purifier when no sulphocyanogen exists in the gas.
6. Ammonia favors the formation of sulphocyanides.

A Primitive Dynamo Factory and Power Station.

By * * *, in *Electrical World*.

It was about the beginning of the year 1889 that certain misguided individuals in a small city of one of the Atlantic States undertook, without the least preparation in the way of either experience or capital, to build electric motors. The moving spirit in this enterprise was a man who had been by turns laborer, bridge builder, man in charge of an agricultural engine, miner, brass moulder, promoter in a small way, inventor all the time, machinist, foreman of a street railway repair shop and general jack at all trades. He had set himself up in a little cellar shop to manufacture commutators for the street railway com-

pany, whose foreman he had been, and incidentally ran a small brass foundry. When I first met him he had about completed arrangements to borrow a little money, use an abandoned turbine wheel at the site of a burned mill near the business center of the city for the generation of electric power, and build motors to be operated on a power circuit of his own. Somehow he succeeded, and when, some months later, he offered me a position to design his motors and generally supervise his work, I thankfully accepted—that being a time when a "job" of any kind was a desideratum.

The shop was about 20 feet square, very dark and most unspeakably filthy. The tools consisted of a small planer, a very small shaper, an old fashioned drill press, two ancient engine lathes and a die press, cutting disks up to about 7 inches diameter, all operated by an old Sprague No. 6 railway motor. There was also the ubiquitous brass furnace, flush with the floor in one corner, and a trough of sand for the use of the one moulder along one side of the room. At the two dirty windows were two benches, equipped with the usual outfit of bench tools, all in a very untidy condition.

The "power house," half a mile away, contained one 40-kw, 220 volt generator, new and in good condition, driven by a belt from a countershaft geared to the vertical shaft turbine of the ruined paper mill. There was water in abundance at an exceedingly low rental.

To my astonishment and surprise I found that the President—that was the position of my friend, the ex-foreman—had a patent which he had bought, presumably for stock, and I was required to conform my designs to the lines of this. As it had been imparted to me in confidence that the troubles of the shop centered in the fact that only one size of motor—5-horse power—could be made to work from the design left by the patentee, my first duties were to make a set of drawings for various sizes of motors. To use the words of the president, other sizes had been attempted, but the "dum things either stood still and bucked or run so fast they bust."

We turned out some pretty creditable motors, everything being considered. Seeing that we had power to throw away we soon loaded our 40 kw. machine to its limit, the condition being that we would allow no other motors than our own on the circuit. Motors were sold cheap, $85 for a 5-horse power, as well as I remember, and business was brisk.

These motors were shunt wound, of a two-pole type, having a cast iron frame in two parts. The lower casting consisted of a pole piece, brackets for the bearing, and a vertical core for the field core. The frames were machined on our planer, bolted together, and set in a wooden cradle on the slide rest of the large lathe to be bored out. The field coil was wound on a sheet copper spool. The armature bearings were of brass, seating themselves in the brackets of the lower pole, which were bored out along with the field opening. The armatures were made of the then prevailing smooth-core type. The core was made of punchings headed up tight between collars on the shaft, one of which was screwed up with a spanner and main strength until the core was "about right" or the shaft sprung. The whole was then covered with unbleached cotton and shellaced, and holes bored in the cast iron heads for the reception of wooden pegs to guide the winder. No provision whatever was made for balancing, this being considered an unnecessary refinement in machines that were sold so cheap. The commutator bars were cast from wooden patterns, and afterwards worked on the shaper with a forked shaped tool, resembling more than anything else the nail-pulling end of a hatchet. This gave them the necessary angle, and subsequent operations brought them down to reasonable fitness for their work. On the whole, they were good commutators for the money, though it was soon found inexpedient to mix bars from different runs of the brass furnace in one commutator. The president had a deep seated affection for old brass bought from the junkman, and I have seen old railroad brasses, gas fixtures, door plates and the like melted up together to be turned into commutators. It is needless to say that nobody could predict the color, hardness or any other quality of the resulting metal.

It was about this time when the loading of the circuits required an enlargement of the power plant, and the question came up for discussion whether it was better to buy a new (second-hand) generator or make one, that the president became imbued with the idea of doing electric lighting. We had the circuits, and the then newly introduced constant potential arc lamps worked very well in series of four on the 220 volts. It was decided to build a new generator, to install all the arc lamps we could find customers for, and to put in a new horizontal-shaft turbine. Meanwhile we bought a second-hand 30 kw., 500-volt generator, and replaced some of our more distant motors with others wound for this voltage. It may be said here that the prevailing sizes were 2 and 5 horse power, the former predominating. It has always been a source of regret to me that we were never able to measure their efficiency, or their current consumption, or the output of the station, because we never had an ammeter. Incandescent lamps brought up to "look about right" answer fairly well as a station voltmeter. I tried to make an ammeter, but never had time to finish it.

It was while we were in the throes of installing the big turbine and getting out patterns for the 75-kw., 220-volt generator with which we proposed to help out the overworked dynamo at the power station that the president came in one day with the news that he had contracted to light the biggest and finest store in the town with 400 incandescent lights, and about 20 arcs. It was obviously impossible, in those days, to work incandescent lights on a 220-volt system. The wiring being in it was equally impossible to make a 3-wire installation of it. It was about a mile from the power house, and I stood aghast at the idea of another generator for this load. The proprietor of the store would not listen to the suggestion of a motor dynamo on his premises—and we had no money (or credit) wherewith to purchase an alternator. The result of a council of war was that the president undertook to get the transformers if I would immediately build the alternator.

In this enlightened day it does not seem possible to simultaneously build a 75 kw., 220 volt compound generator and a 50-kw. alternator in a shop 20 feet square, with the outfit of tools described above, but we did it. The direct current machine was comparatively easy, most of the machine work being "hired out" to other shops. We made the commutator ourselves, however, and did the winding. The machine worked fairly well; that is, it didn't get very hot in service or spark unduly at the brushes.

The alternator was a different sort of problem. In both this and the direct-current machine we were brought up standing by the difficulty of getting disks for the armatures. A simple, if somewhat barbarous expedient, solved this, however. We cut up a number of squares of thin iron, about 20 inches square, and punched a 6-inch hole through the center of each. These were then placed on a wooden template, and an 18-inch circle drawn on them with a slate pencil. Two able-bodied boys with tinsmith's shears did the rest. It was slow, but we got the disks. These, being clamped on the shafts, were subsequently turned up with much expenditure of labor and profanity. We had hired a small room near the shop, and there installed the pattern maker and winder, and there the work on the two big machines went along with comparative satisfaction.

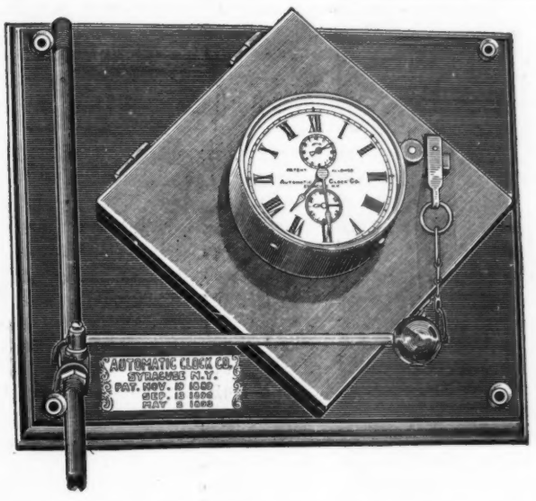
The alternator was of a mongrel type, having 16 poles in its stationary field ring. The armature was mounted in centers on the bed of the planer and slotted, the coils being made on a wooden frame and slipped on. It may as well be stated here that the writer's knowledge of alternators was not large at that time.

It was a breathless moment when, the alternator being finished, we started it turning, brought it up to speed and threw on the exciter current. As I have related we had no manner of measuring instruments. The transformers had not arrived, and it was determined to use twenty 50-volt lamps in series to see if we could get the expected 1 000 volts out of the machine. A boy at the shop was delegated to mount the twenty lamps on a board and connect them in series. Unfortunately he connected them the only way he had ever seen lamps connected, and no one had time to see if the work was properly done. The board of lamps was hung from the ceiling of the dynamo room, and at the proper moment, all connections having been made, the main switch was thrown. Those who have seen a 50-volt lamp explode under a pressure of about 1,200 volts, alternating, will know what the resulting pyrotechnic display looked like. It cannot be described.

The cut in the price of light made by the president when we got the alternating circuit going attracted the attention of the local electric light company, and our independent existence was brief. This tale has been told to show what the possibilities of electrical machinery are, and to illustrate what can be done in a small machine shop when necessity drives.

Automatic Clock Gas Shut-off.

Messrs. William M. Crane & Co., of New York, inform us that the automatic clock and gas shut-off (bye-pass) shown in the accompanying illustration, has become quite a prominent factor in the gas appliance trade. It tends to please the gas consumer through shutting off or reducing the gas pressure in show windows, or on meters in halls or public buildings in general, at any set hour, thus saving needless expenditure for gas and doing away with the inconvenience, annoyance and uncertainty of not having the work done at the desired time.



Gas companies are interested from the fact that many merchants prefer improved incandescent gas burners, at the ruling low price of gas, compared with high meter rates and low illuminating power of incandescent electric lights. Heretofore many used gas in the body of their stores and electric lamps in their show windows, because electricity could be shut off at night or at other time, either from outside or automatically from the inside of the store, without dangerous results if tampered with. With the advent of the automatic clock, merchants are rapidly taking on the better light at cheaper cost. The gas companies, too, are advertising and encouraging the use of gas stoves and heaters. These, in connection with the automatic clock and gas turn on bye-pass, insure a warm house at any time in the morning, without disturbing the refreshing slumbers of anyone.

The mechanism of the clock is of the best workmanship, and its operation is extremely simple. The bar of the clock, as shown in the cut, slides into the clock at the set time, thus removing an obstruction and allowing the traveler, with chain attachment and bar, to roll from the inclined track on which it is resting, shutting off or turning on the gas entirely, or leaving bye pass pressure.

The gas cocks are manufactured expressly for the purpose, and in two sizes only, one inch and one-half inch, the gasfitter using a nipple and an enlarged or reduced point, as may be necessary to meet requirements.

A year's guarantee is furnished with each clock. The clocks and cocks are mounted on handsomely finished boards, which may be easily screwed to the wall surface when all is in readiness for gas piping.

Sloping Retorts in Germany.

The *Gas World*, referring to the latest report of the "Committee on Inclined Retorts," named by the German Association of Gas Engineeas to investigate that subject, says the Committee's report was partly as follows: In Chemnitz the town gas works has had five benches of inclined retorts up since 1895, and six others were put up in 1896, each bench containing nine retorts. In those of 1895 the heats were higher in the lower parts of the retorts, while in those of 1896 the temperatures are more equalized, so that in these latter there are no deposits of tar at the mouthpieces. The chimney is not adequate for all the work put upon it, for it has to serve too steam boilers and an ammonia works as well as the retort fires. The coals are sifted over a 3-inch mesh. The broken coal is lifted by mechanical means, and supplied from a store in a position above that of the retorts. It requires about one workman per bench, and not less than three workmen in any case. The coal carbonized is Zwickau coal; five charges per 24 hours; charges 490 pounds; yield per retort per diem 10,240 to 10,600 cubic feet of gas. As to formation of graphite and blocking of the ascension main, these were much the same as with horizontal retorts. Results considered entirely satisfactory; the saving in wages being about 25 per cent.

In the town gas works of Dresden there are, in the Neustadt works, four benches (two of these were put up in 1891) and in the Reik works ten benches (five in the year 1894–5 and five in 1896), each with nine retorts, 11 feet 8 inches long and of elliptical section. The results have been very favorable. Charges, six in the 24 hours; Saxon and Upper Silesian coal together give from 12,714 to 13,067 cubic feet per retort per diem. Upper Silesian coal used alone gives 14,127 cubic feet per retort per diem. The newer construction gives very slight differences between the heats in the lower and upper parts of the retorts, and, therefore, tar does not accumulate at the mouthpieces. The 1891 retorts had a slope of 30°; now a slope of 32° is used, for the coke did not slip freely enongh with the former angle, particularly when the retort was getting a little old; and the apprehension at first felt, that 32° would not make an even layer has been proved groundless, so far so that it is now intended for the future to use an angle of 33°. The coal used is naturally in cubical pieces and does not need to be broken; and it is lifted into position by hydraulic power.

In Cassel the new town gas works, opened at the end of 1894, is entirely fitted with inclined retorts. There are ten benches, each of nine retorts of 11 feet 8 inches in length, and two more benches are being put up this year. The coal (Westphalian) is broken into lumps the size of the fist, and sent up to bunks in the roof, to be let down afterwards to the retorts. Charges, five in the 24 hours; average yield of gas, with 425 pounds coal per charge, 9,641 cubic feet per retort per diem, or 10,145 cubic feet per ton (English). The same remarks are made as to getting rid of tar at the mouthpieces by equalizing the heats over the retort in the newer constructions.

Analogous results are reported from Witkowitz and from the Imperial Continental's Erdberg works, Vienna. The results obtained at the last-named works, which have had one bench with 7 retorts since 1889, and 11 benches with 9 retorts since 1890, have been such that the Imperial Continental is now putting up 26 benches of 9 retorts each in its Berlin works in the Gitschinerstrasse. The Berlin municipal gas works (Mullerstrasse) has 6 benches of 6 retorts each, of which 4 date from 1891 and 2 from 1894. The slope is 32°, and the retorts are 11 feet 6 inches long, with an elliptical section of 20.8 by 15.6 inches. By equalizing the heats in the later retorts the deposition of tar has been got rid of. In 1895 there happened to be an opportunity of making comparative tests, using horizontal retorts 9 feet 4 inches long, with an elliptical section of 20.8 by 15.6 inches. The production of gas (with 6 charges per 24 hours) stood at 9,712 cubic feet of gas per horizontal retort per diem, as against 10,595 cubic feet for the sloping retorts. The formation of graphite was more rapid in the inclined than in the horizontal retorts. The lighting power was 16.49 candles, with a yield of 10,309 cubic feet per English ton, with the horizontal retorts; while with the inclined retorts it was 16.25 candles, with a yield of 10,106 cubic feet per English ton. The results are, on the whole, very satisfactory, and it has been resolved to put up, during this and next year, 9 benches in the Mullerstrasse works, and 20 in the Schmergendorf works.

Inclined retorts have also been recently put up in Altona, but no reports as to their working are yet at hand. Kiel, Danzig, Konigsberg, Zurich, Geneva and other places are also putting up these retorts.

The Committee does not think that the time is yet ripe for laying down any positive rules for construction, but it gives some of the results of experience as showing what are good constructions. It is assumed that there is no restriction arising from the limitations of existing buildings. The "front" of the retort is its lower end, the "back" its upper end. The generator furnaces are to the front of the bench, either sunk underground or projecting in front of the bench. The drawn coke is removed either in ordinary two-wheeled coke wagons or in iron tip-wagons.

The depth of the hollow from which the generator furnaces are stoked should not be under 10 feet, and would better be somewhat greater.

Typical Dimensions.—As to the amount of space required behind and in front of the benches, the following show the way in which this depends on the differences between the working level and the yard level.

Case 1. House with one row of benches and closed front walls; the floor in front of the retorts on the same level as the yard. There should be at least 16 feet 8 inches in front of the benches, better 20 feet, while the producer furnace hollow measures 10 feet 8 inches to 14 feet, if between projecting producers. With producers built in, the space above will have to be limited to 16 feet 8 inches. For the working space behind the retorts, where the workmen are subject to radiant heat, 13 feet 4 inches is an extremely low limit; it should not be less than 16 feet 8 inches.

Case 2. House with one row and closed front walls; working level in front of the retorts one stage higher than the yard. The drawn coke falls to the lower story and is wheeled out to the yard. Dimensions, minimum between retorts and front wall 20 feet, better 26 feet 8 inches; between retorts and back wall 16 feet 8 inches; depth of cellar 14 feet,

minimum. The front wall may be correspondingly nearer when the producers are built in beneath the retorts.

Case 3. House with one row of benches; the front walls consist of pillars with a sliding door opposite each furnace. Producer furnace built in. Working level the same as that of the yard. In this case the distance between the benches and the sliding doors may be reduced to 3 feet 4 inches and between the retorts and the back wall to 10 feet.

Case 4. Two rows of benches, parallel to the front wall. Front floor level the same as that of the yard. Dimensions between wall and retorts 16 feet 8 inches, better 20 feet; between the two rows of retorts 26 feet 8 inches, better 35 feet. The chimney is not put between the benches; if it be, the middle gangway must be considerably wider. This remark applies also to the next four cases.

Case 5. Two rows of benches as in Case 4; front floor level a stage above that of the yard. Dimension between walls and retorts 20 feet, better 26 feet 8 inches; between rows 26 feet 8 inches, better 35 feet.

Case 6. Two rows of benches as in Case 4, but facing one another. Dimensions between walls and retorts 16 feet 8 inches; between rows 30 feet, better more.

Case 7. Two rows of benches facing one another; the level of the front floor a stage above that of the yard. Dimensions between walls and retorts 16 feet 8 inches; between rows 33 feet 4 inches, better more. Cases 4 and 5 are generally more convenient than Cases 6 and 7 for transport and handling of coal and coke. When there are two rows of benches, and the four walls consist of pillars with sliding doors, Case 3 shows the necessary modifications.

Case 8. Benches arranged at right angles to the front walls. Four rows. Between each two facing rows 30 feet to 33 feet 4 inches; central space a minimum of 26 feet 8 inches.

In all the preceding it is assumed that the roof is free and is not supported by pillars in the retort house; if otherwise, the dimensions will have to be altered.

The height of the bench is about 5 feet greater than with horizontal retorts so long as the front and hind walls of the bench are not more than about 10 feet apart. If the retorts be of extra length this will cause a further increase in the height. The clear roof space above everything should be at least 6 feet 8 inches, but this depends also upon the arrangements for working the coal. The coal shed is connected with the retort house by a line of rail. The transport of coal may be managed in several ways; but simplicity and ease of working, and consequent cheapness, should always be kept in view; and there should always be a sufficient reserve, to meet contingencies, of duplicate parts. The coal hoppers above the benches should be large enough to hold 24 hours' supply at once, so that if anything went wrong with the carrying machinery there might be time for repairs.

Shape of Retort and the Angle—As to the best form of the retorts, there are no conclusive results available; the coal slides better in flat bottomed retorts, but elliptical retorts hold more. The circular section is clearly the worst, partly on account of friction, partly on account of the unequal thickness of the layer. Very wide retorts seem not advantageous, on account of the unequal carbonization and the unequal quality of the coke. The retort should widen as it comes down, in order to allow the coke to slip out better; say 1.2 to 1.4 inch wider at the front than at the back, but the same height throughout. The retorts in use vary from 11 feet 3 inches to 15 feet 3 inches in length, the last size being made up of two pieces. The angle of 32° has been preferred, but the tendency now is to use 33°. The distance between the lowest range of retorts and the floor should not be less than 2 feet 6 inches; if it be much greater than this, the handling of the upper retorts becomes more difficult. Fixed retort doors instead of free ones have done well; but in Dresden series of flat iron bars have been used with advantage. The exit pipe for gas comes off in all cases at the lower end of the retort; experiments with it at the other end have not succeeded, for the ascension pipe gets blocked with tar, and, further, tar coke is formed at the back of the retort, so that the contents don't run; and in that position its removal is difficult. At the back of the bench, shields of iron should be put up near the ends of the retorts, to protect the workers from the radiant heat.

The construction should be such as to heat the front of the retorts a little more than the back, contrary to the usual custom with horizontal retorts. This hardens the coke and prevents the deposition of tar in the ascension pipes. Producer firing is essential to the working of inclined retorts; they need not be put up where this is not available. Coal broken to 2.4 to 3.2 inch lumps works best. The retort fillers should contain a complete charge, and should be capable of delivering the coal with greater or less rapidity. Mr. Drory calculates a considerable saving of ground through the use of inclined retorts. How far inclined retorts are suitable for small works depends on whether producer firing is available, whether the machine power required for handling the coal is available, and whether the number of workers employed at the slackest time of the year is sufficient. Where there are not at least two benches at work in the slackest season there is no advantage in inclined retorts.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

A CORRESPONDENT at Leavenworth, Kas., writing under date of the 10th inst., says: To the Editors AMERICAN GAS LIGHT JOURNAL: Often I notice in your "Items of Interest from Various Localities" statements regarding the numbers of gas cooking stoves, heaters, etc., sold or otherwise put in service by the managers of different gas companies. In connection with such statements I thought perhaps a hint about what had been done in that direction by the Leavenworth Light and Heating Company would not be amiss. Between March 1st and October 1st, 1897, over 300 gas ranges were sold; during the current month many heating stoves of different types have been put out, and inquiries for others are constantly being made. Mr. L. T. Palmer, the Manager of the Company, is pleased over the development of the gas business in Leavenworth, and he should be; for the increase in output since his advent here is certainly not less than 30 per cent. The works are also being enlarged and improved.—A. F.

MR. GEORGE W. COBB, formerly in the auditing division of the Philadelphia municipal gas plant, has been appointed Tax Auditor, in the office of the City Controller.

MR. CHARLES H. NUTTING has resigned the Superintendency of the Chicopee (Mass.) Gas Company, the resignation to take effect December 31.

THE proprietors of the Belvidere (Ills.) Gas Light and Fuel Company have awarded contracts for the enlarging of that plant.

THE first dividend on the shares of the Peoples Gas Light and Coke Company (the Company now representing the consolidated gas interests of Chicago) is payable next Wednesday. The dividend (1¼ per cent.) puts the stock on a 6 per cent. basis.

MR. E. D. WRIGHT, Clerk to the Metropolitan Gas Referees, London, England, informs us that the offices of the Referees have been removed to 66 Victoria street, S.W., London.

MR. ROBERT B. TABER is our authority for the statement that, from and after December 1, 1897, illuminating gas of standard candle power will be distributed by the South Framingham (Mass.) Gas Company. The rates agreed upon are: For an illuminating use, $2 per 1,000, with a discount of 10 per cent. for prompt payment; for gas stoves, engines, etc., $2 per 1,000, with 25 per cent. off for prompt payment. So, there's an end to lean fuel gas in South Framingham.

WE regret to report the death of Mr. James K. Ford, of Paris, Ky., whose summons came on the afternoon of November 1st, the immediate cause of his death having been paralysis. Deceased, who was in his 35th year, had been President of the Gas Company, of Paris, Ky., since January, 1892. Mr. Ford was senior member of the hardware house of Ford & Co., of Paris, and was also proprietor of the Hotel Fordham, of the same city. His widow survives him.

MR. A. SHIRE, Secretary of the Gas Company, of Paris, will act also as the President of that concern until the annual meeting, which will be held early in 1898.

UNDER the reorganization of the Universal Gas Company, of Chicago, and the Mutual Fuel Gas Company, of the Hyde Park district of the same city, the officers chosen were: Universal Company—Directors: Hugh J. Grant, W. S. McCrea, A. R. Flower, F. S. Flower, Henry Bronk, Charles A. Stadler and C. L. Day; President, H. J. Grant; Vice-President and Treasurer, W. S. McCrea; Secretary, C. L. Day. Mutual Company—Directors: F. E. May, J. S. Morris, E. N. Wiley, R. M. Shaw, J. T. Maher, Walter Ayer and J. D. Black; President, F. E. May; Vice-President, R. M. Shaw; Secretary, J. S. Morris.

THE proprietors of the Worcester (Mass.) Gas Light Company have purchased the buildings on No. 240 Main street, Worcester, formerly the headquarters of the State Mutual Life Assurance Company. The plot has a frontage of 40 feet, and an area of 3,450 square feet. The

building is of marble, and is 4 stories high. The Gas Company will, in part at least, occupy the premises for office purposes.

EDWIN B. CALDWELL, who is, said to be the controlling spirit in the fuel gas melange at Kalamazoo, Mich.—otherwise known as the Kalamazoo Heat, Light and Power Company—is before the Council of the Cicero district of Chicago, asking for an amendment to what is known as the Miller franchise (passed in June last) that will permit him to manufacture and distribute gas in Cicero.

MR. JOSEPH W. ALLEN, a prominent citizen of Nashville, Tenn., is urging the proposition that the authorities shall purchase the plant of the Nashville Gas Light Company and operate the same on public account.

The Le Mars (Iowa) *Sentinel* says that the proprietors of the Le Mars Gas Company, having determined that experimentation with odd water gas-oil processes is not profitable, have remodeled their plant, so far as its generating capacity and plan are concerned, in accordance with the principles underlying modern water gas sets. We have not been informed as to the details of the Le Mars new work, nor as to the names of the constructing firms. However, it is enough to know that the Le Mars men are up and doing.

THE new boiler house that is being erected by the Waterbury (Conn.) Buckle Company will have a roof of corrugated iron, supported on steel trusses. The building is to be 36 feet in width and 48 feet in length, the side walls to be of brick. The aim of the proprietors is to have the structure fireproof in all possible respects. The steel work for the buildings is being furnished and erected by the Berlin Iron Bridge Company, of East Berlin, Conn.

LITTLE "Jaky" Cantor, who represents the 20th Senatorial district in the New York State Senate, and whose term of office expires December 31, 1898, is already in the field with the announcement that he proposes to try for dollar gas again. Last year he fought valiantly for such a measure, as did others of his law-making brethren senators, McCarren and Coffey included; in fact, we had almost forgotten to include Senator McNulty in the quartette of those who so unsuccessfully strove for cheaper gas. Possibly Mr. Eugene Wood should have credit too for having assisted in the attempt; but as Mr. Wood is not a member of either the upper or lower house, we will let him pass. The Hebraic element in little "Jaky," is as pronounced now as it ever was; but the gentleman from the 20th district should bear in mind that a sacrifice once made is made for all time. Of course, it is not possible that Mr. Cantor could hope to succeed himself in the Senate, much less that his thought should lead him to try for higher place with more money in its train, for those who put him where he is are not satisfied with the extreme lastingness of his devotion to any other cause than that of Jaky's. Had he been satisfied with taking unto himself the direction of the minority party in the Senate there might not have been much cause for complaint, for his brilliant acetylene gas measure, of March 4th, 1896, is still remembered by many; but when it comes to his saying what shall, will, can or may be done by the incoming Assembly, regarding gas rates in New York city, looks a bit gratuitous, to say the least. This reference to little "Jaky" is prompted by an article in the *Mail and Express*, of New York, under date of November 16th, the sentiments of which article had not been repudiated publicly by its putative author at the time of our writing. The *Mail and Express* says: "State Senator Jacob A. Cantor stated to-day that it was his purpose to renew his fight this winter in the Legislature for dollar gas for Manhattan and Bronx boroughs. 'I look for better results in this Legislature than I had in the last one,' said Senator Cantor, 'for there is no doubt that a dollar gas bill can be passed through the Assembly. Of course, as the Senate is a holdover body from last winter, I can only rely on the force of public opinion, and the attitude of all parties in the recent campaign to win the Senate over to the measure.' 'Will you introduce your former bill?' 'In its essential features, yes,' replied Senator Cantor, 'and I believe that it should be confined to Manhattan and Bronx boroughs, for Brooklyn has entered into a contract with the Gas Companies, and I am not sure that the conditions in Richmond and Queens boroughs justify applying to them the rigorous terms of the law I propose. The bill not only fixes the price and quality of gas, but also creates a municipal commission to regulate and supervise the matter. My last year's bill named the Mayor, Comptroller and Corporation Counsel as the commission. It would probably not be advisable, under Greater New York, to have those three officers named in the new bill as the commissioners, but I favor confining the commission to city officers elected by the people. Just how the matter will work out I do not yet know, for I have not yet given thought to the measure, except in a general way. I shall do so, however, in time to have *my* bill before the Legislature on the first day of the session, and I propose to urge it as rigorously as I know how."

THE new holder for the Grand Rapids (Mich.) Gas Company will be ready for use in a fortnight.

THE Warren (R. I.) Gas Company has shut down its gas plant. The electric portion of its business will be maintained.

THE Lowell (Mass.) *Mail* had this to say in a recent issue: "Mr. Arthur Staples makes the suggestion that the deterioration of the gas pipes in the city hall and in the memorial building, which has been discovered, is due to the effect of electrolysis rather than to any other cause."

THE Boston (Mass.) *Globe* reports that a preliminary hearing was had on the 9th inst. before the Board of Gas and Electric Light Commissioners, on the petition of Mayor Perry, of Somerville, which he was instructed to file with the Board, asking for an equitable adjustment of the prices charged the city for its lights by the Somerville Electric Light Company. The full Board heard the evidence, President Barker directing the proceedings. Mayor Perry opened the case for the city. He said in part: "Our city has been under contract for the past five years with the Somerville Electric Light Company to furnish light at the rate of $120 a year for an arc light of 1,200-candle power, and $25 a year for incandescents. That contract expired October 1 last. It is necessarily a monopolistic company, advantageously so. Patronage is compulsory. We must take what is offered, and at the Company's price, or go without it. It asks for extraordinary privileges which are just and right. If you can give us a lower schedule I should be glad to have it done."

Alderman Lamont next spoke. He said in part: "At the inception of this movement I gave my opinion, backed up with figures which the closest impartial investigation, given by a special committee appointed by the City Council, has fully confirmed, that from $75 to $90 is as much as we should pay. I am still of the opinion that our city is paying a greater price than it should, and nearly double that for which a plant owned and operated by the city could produce a like result.

"Should we not receive the reduction we hope for from your honorable commission, then the city should not be dilatory in exercising the authority conferred under chapter 370 of the Acts of 1891, enabling cities and towns to manufacture and distribute gas and electricity, and thus obtain relief from what our citizens consider a heavy and unnecessary drain on our city treasury."

Councilman Story next spoke. He presented volumes of figures and statistics. He said that the Company had been paid enough money in the past five years by the city to establish a new plant. He said that in the last five years the city had paid more for 1,200-candle power arc lights than any other city in the State. He said that the price—$120—paid for each light per year was relatively higher than was paid in any other city for 2,000 candle power lights. He claimed that the Company could manufacture light cheaper than most cities. He claimed that the excessive price charged was due to high capitalization and the peculiar financial policy of the Company. He estimated that the cost of a new plant would be $125,000, and said that as a result the city of Somerville was paying a dividend on $75,000 worth of stock in excess of the actual cost of the plant to day. He said that the service was poor. In cross-examination he said that the Superintendent of the Company had stated to the committee that the poor quality of the light was due to the quality of the carbons used. Mr. Story was very emphatic that the lights were poor; so much so that he remarked it was "a mighty good thing we have a moon here in Somerville." Mr. Story submitted an estimate of the cost of an electric lighting plant to be established by the city, amounting to $125,000. Counsel Burdett characterized the figures as absurd, and the commissioners closely questioned the witness on the various items. Mr. Story said that he obtained his figures from various business firms on *bona fide* bids they had made to furnish them machinery and work. A warm wrangle ensued over the identity of these firms. Mr. Story wished to keep their names private, except to the commissioners, as he said that efforts had been made to boycott firms supplying municipal plant. Counsel desired to know them to determine their responsibility, and Alderman Berry vigorously demanded that the names be made public.

Several Aldermen took part in the contest, which was finally decided by turning over the letters from the various firms to the commissioners, and giving the Electric Light Company's officers the privilege of examining them at the commissioners' office, under the promise that they would reveal them to no others. Alderman Ball stated that the members of the special committee on investigation felt confident of backing up the figures presented by Mr. Story. The hearing was then adjourned to the 18th inst.

THE AMERICAN GAS LIGHT JOURNAL

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MONDAY, NOVEMBER 22, 1897.

The Market for Gas Securities.

The Stock Exchange gamblers have again turned their attention to a full tackling of Consolidated gas, with the result that the ball is now well under control of the bulls. Early in the week the professionals marked the stock well under 180, but later on the game turned, and with something like startling suddenness. The high price Thursday (yesterday) was 187, and the high price at noon to day (Friday) was 194. Realizing sales sent the figure down to 190¼ by 1 P.M. There was large trading in the stock, and the market was strong and firm enough to take all that was offered. We have no reason to recant anything said in these columns for many past months respecting the value of Consolidated gas shares. It is merely a question of time when our highest estimate as to their worth will be verified. The newspapers that are now prognosticating in respect of gas consolidation in this city have printed not a little trash, but some of the stories have been fairly well connected, especially the one printed by the Brooklyn *Eagle* in its issue for the 18th inst. Those who hold Consolidated gas on investment account should continue to hold it, for it is a good thing to have and to keep. City gas shares in general are buoyant, Mr. Sage's shares even having shown marked betterment. Out-of-town shares are in fairly good demand, Peoples, of Chicago, being quoted at 93¼ to 93⅝, ex dividend of 1½ per cent.; Bay State remains at the figures of a week ago, although it spurted up to 7 on the 17th inst. on the strength of a curiously compiled statement in the newspapers of that date. Brooklyn Union is strong at 119 ex dividend, and Detroit gas is a trifle weaker, although it more than well sustains its recent marked advance. Lacledes are steady, as is Baltimore Consolidated, which is 54 bid ex div. of 2 per cent. The Welsbach Commercial Company has declared a quarterly dividend of 2 per cent. on the preferred stock, payable Dec. 10th. The American Gas Company has declared a semi-annual dividend of 3 per cent., payable Dec. 1st.

Gas Stocks.

Quotations by Cochran & Close, Brokers and Dealers in Gas Stocks.

35 WALL ST., NEW YORK CITY.

NOVEMBER 22.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$35,430,000	100	188	189
Central	500,000	50		..
" Scrip	220,000	..	100	.
Equitable	4,000,000	100	280	290
Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	114	.
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	..	350
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	.	..	.
Northern	150,000	50	..	
" Bonds	150,000	1,000	..	98
New York and East River	5,000,000	100	79	81
Preferred	2,000,000	100	98	104
Bonds 1st 5's	3,500,000	1,000	112	113
" 1st Con. 5's	1,500,000	..	105	106½
Richmond Co., S. I.	348,650	50	50	..
" Bonds	100,000	1,000	..	..
Standard	5,000,000	100	134	136
Preferred	5,000,000	100	145½	150
Bonds, 1st Mortgage, 5's	1,500,000	1,000	114	115
Yonkers	299,650	50	130	
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	119	120
" " Bonds (5's)	15 000,000	1,000	110¼	110½
Bay State	50,000,000	50	6	6¼
" Income Bonds	2,000,000	1,000	..	35
Boston United Gas Co.—				
1s Series S. F. Trust	7,000,000	1,000	93	..
2d " " "	3,000,000	1,000	80	81
Buffalo Mutual	750,000	100	125	..
" Bonds	200,000	1,000	95	100
Central, San Francisco	2,000,000	..	95	..
Chicago Gas Company	25,000,000	100	97¼	97⅜
Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Columbus	1,069,000	.	91	94
1st Mortgage	1,085,000	..	..	96
Consumers. Jersey City	2,000,000	100	72	78
" Bonds	600,090	1,000	100	..x
Cincinnati G. & C. Co.	8,500,000	100	201	202
Consumers, Toronto	1,600,000	50	184½	187
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Consolidated, Baltimore	1,000,000	100	54¼	54¼x
Mortgage, 6's	3,600,000	..	107	107½
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490,000	..	..	..
Detroit	4,000,000		57½	58
" Con. Bonds	4,312,000	..	85	90
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Fort Wayne	2,000,000	..	81	85
" Bonds	2,000,000	..	93	95
Hartford	750,000	25	..	145
Indianapolis	2,000,000	..	118	125
" Bonds, 6's	2 650,000	..	107	109
Jersey City	750,000	20	180	..
Lafayette Gas Co., Ind	1,000,000	100	86	88
Bonds	1,000,000	1,000	92	94
Louisville	2,570,000	50	..	..
Laclede, St. Louis	7,500,000	100	40	40¼
Preferred	2,500,000	100	90	95
Bonds	9,084,400	1,000	101	101½
Little Falls, N. Y.	50,000	100	..	100
Bonds	25,000	..	..	100
Montreal, Canada	2,000,000	100	200	.
Newark, N. J., Gas Co	1,000,000	..	200	220
Bonds, 6's	4,000,000	..	128	130x
New Haven	1,000,000	25	225	..
Oakland, Cal.	2,000,000	..	53½	54
" Bonds	750,000	..	..	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	93½	93⅝
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,00	1,000	..	108
2d "	2,500,000	1,000	104	105
Peoples, Jersey City	500,000	50	..	175
Rochester Gas & Elec. Co.	2,150,000	50	..	..
Preferred	2,150,000	50	88	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	10.000,000	100	94	94½
St. Paul Gas Light Co.	1,500,000	100	49	51
1st Mortgage, 6's	650,000	..	84	87
Extension, 6's	600,000	..	..	.
General Mortgage, 5's	2,400,000	.	88	90
Syracuse, N. Y.	2,500.000	25	19	20
Bonds	1,000 000		98	100
Washington, D. C.	2,000,000	20	250	
Western, Milwaukee	4,000,000	100	83	85
Bonds, 5's	3,556,000	.	98	100
Wilmington, Del.	550,000	50	200	202

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Continental Iron Works, Brooklyn, N. Y. 834
Deily & Fowler, Philadelphia, Pa. 836
Davis & Farnum Mfg. Co., Waltham, Mass. 832
Kerr Murray Mfg. Co., Fort Wayne, Ind. 832
Stacey Mfg. Co., Cincinnati, Ohio 835
R. D. Wood & Co., Philadelphia, Pa. 834
Logan Iron Works, Brooklyn, N. Y. 836
Riter & Conley, Pittsburgh, Pa. 819

GAS SECURITIES.

Marquand & Parmly, New York City 815

DIVIDEND NOTICE.

OFFICE OF THE AMERICAN GAS COMPANY,
222 S. THIRD ST., Phila., Pa., Nov. 17, 1897.

The Board of Directors of The American Gas Company have this day declared a semi-annual dividend of 3 per cent., or $3 per share, on the outstanding Capital Stock of the Company, payable on and after Dec. 1, 1897.

1172-1 MORRIS W. STROUD Treas.

DIVIDEND NOTICE.

OFFICE OF WELSBACH COMMERCIAL COMPANY,
40 WALL ST., NEW YORK CITY, Nov. 11, 1897.

The Directors have this day declared a quarterly dividend of two (2) per cent. on the preferred stock, payable Dec. 10, 1897, to stockholders of record at the close of business Nov. 30, 1897. Transfer books of the preferred stock will be closed from Dec. 1 to Dec. 10, 1897, both inclusive. Checks will be mailed

1172-3 EDWARD C. LEE, Treasurer.

GAS ENGINEER AND CHEMIST,

age 32, is open to take charge of a coal, oil, or water gas plant. Will travel for responsible firm. Has had experience in working inclined retorts. First-class references and testimonials. Address

1172-6 "G.E.C.," care this Journal.

Position Wanted

As Superintendent of Gas Works.

Has had 19 years' experience in the manufacture and distribution of water gas, in works with a capacity of 100,000 to 5,000,000 cubic feet per day. Best of references. Address

1169-7 "W. J. B.," care this Journal.

WANTED, TO BUY OR LEASE,

A Small Gas Works

within 100 miles of New York City. Address

1170-tf "INVESTOR," care this Journal.

Gas Plant Wanted.

If you have a Gas Plant for sale in a city of 6,000 to 15,000 population, address

1169-4 "F. and F.," care this Journal.

WANTED,

Four 8 x 10 ft. Purifiers and Center Seal, with 8-inch connections. Also,

Good Washer, Condenser, Station Meter and Roo s Exhauster.

Must all be in first-class repair. Address

1171-2 "B. A.," care this Journal.

FOR SALE,

One 8-Inch Kerr Murray Center Seal.

In good condition. For sale because too small for works.

Address The DALLAS GAS AND FUEL CO.,

1171-2 Dallas, Texas.

For Sale or Exchange,

Modern Gas Plant in Growing Pennsylvania City.

Capacity of works, 75,000 cubic feet per day; 11 miles of mains. Splendid bargain for the right party. Address

1171-4 "T. G. C.," care this Journal.

For Sale.

A Small Gas and Electric Light Plant,

in a Southern city of 3,800 inhabitants.

Address FORT WAYNE ELECTRIC CORPORATION,

1097-tf Fort Wayne, Ind.

FOR SALE.

Hydraulic, Dip, Branch and Ascension Pipes, Mouthpieces and Lids, for four Benches of 5's and for one Bench of 3 retorts.

Two Coolers, or Air Condensers, each of 150'000 cubic feet capacity.

Multitubular Condenser, shell, 36 in. diameter, with 98 2-in. tube , 10 ft. 6 in. long.

D-Shaped Tar Extractor, 8 ft. long, 1 ft. 6 in. deep.

Scrubber, 48 in. diameter, 11 ft. 9 in. high. Three man holes, 11 in. by 15 in.

S-inch Center Seal. Four Purifiers, 8 ft. x 6 ft.

KEY CITY GAS CO

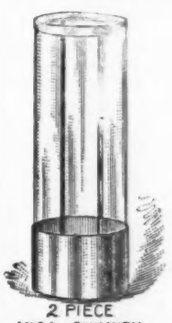
1119-tf Dubuque, Iowa.

MARQUAND & PARMLY,

160 Broadway, New York.

Members New York Stock Exchange.

Our Mica Chimneys



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Incandescent Gas Lamps and Mantles.

Our Mantles are strictly hand-made—no machine work; of extraordinary tenacity and durability, and of superior illuminating power (average 80 to 90 candle lights). Can be used on any Incandescent Gas Burner. Contracts made for large quantities, delivery to suit. Supply the trade only at rock bottom prices. The SPENCER LAMP is the most satisfactory and cheapest on the market. Sole agency given. Address for particulars, **SPENCER GAS LIGHT CO., 225 Dearborn St., Chicago.**

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Maxim & Clough Adjustable Gas Burners

E. H. Nickel Tips for Water Gas a Specialty.

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Utilize Your Gas Liquor.

NO EXTRA LABOR OR OPERATING EXPENSES.

Ammonia Concentrator,

Not Expensive. Write to STROH & OSIUS, Pat'ees, or Mich. Ammonia Works, Detroit, Mich.

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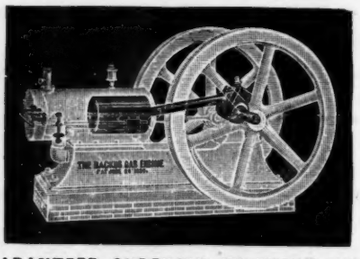
For Gas Purification.

Acts immediately, and more efficiently than any other purifying agent now in use.

GREENPOINT CHEMICAL WORKS,

Greenpoint Ave. and Newtown Creek, Brooklyn, N. Y.

BACKUS GAS ENGINES



GUARANTEED SUPERIOR IN EVERY WAY. BUILT ON HONOR.

Agts. { Chicago Water Motor & Fan Co., 161 Lake St., Chicago. Michell & Co., - - 154 Congress Street, Boston, Mass.

Home Office, **Backus Water Motor Co.**, Newark, N. J.

Send for Catalogue.

CHARGING CARS, to bring coal from storage bins to boiler room and retort houses.

No 94122 Copyright, 1894, by C. W. Hunt Co.

COKE CARS, for handling hot coke directly from retorts.

TIP CARS, for carrying ashes, etc.

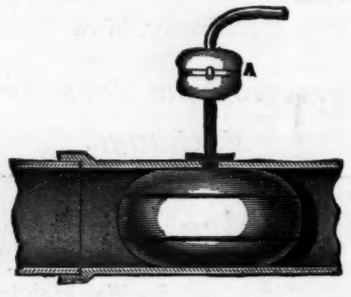
The difficulty of handling hot coke directly from the retorts led us to design a special car for this purpose, with an arrangement of piping which sends a spray of water over the entire surface of the sides and bottom, preventing the steel from becoming overheated when the hot coke is drawn into the car. This is not intended to entirely quench the coke, which is done in the usual manner, but to keep the iron from getting red hot, and, at the same time, to partially quench the coke.

We have just issued a new, 40-page, illustrated Catalogue, No. 9703, giving full description of our Industrial Railways. Before you forget it, send for a copy.

C. W. HUNT COMPANY,

No. 45 Broadway, - New York City.

Peerless Patent Improved Gas Bag



These Gas Bags are used to stop the flow of gas while repairing or making alterations in gas mains. There have been numerous cases of workmen being badly injured, and sometimes fatally, by the escape of gas resulting from the bursting of a bag, and our patent improvement is designed to obviate such calamities. The indicator *A* shows unerringly when the bag has been sufficiently inflated to pack the main, and when the pumping should be stopped. Our Bags are made of a rubber stock especially prepared to admit of great distension, and to resist the action of Oils, Gases, Naphtha and other residuum in the mains, and they are made with lapped joints, which adds greatly to their strength.

3-in. Gas Bag, each,		$0.60	12-in. Gas Bag, each,		$5.00
4 "	"	.80	16 "	"	8.25
5 "	"	1.05	20 "	"	12.00
6 "	"	1.75	24 "	"	17.00
8 "	"	2.65	30 "	"	27.50
10 "	"	3.75			

The Peerless Rubber Mfg. Co.

16 Warren St., N. Y. City.

"RANGITOL" Ready Incandescent Light Preparation, in Powder Form or Liquid.

Furnished in Excellent Quality Cheaply.

DR. PHILIPP HIRSCH, Chemical Works, PANKOW-BERLIN.

NITRATE OF THORIUM, Chemically Pure, at the Cheapest Price. SAMPLES FREE IF DESIRED.

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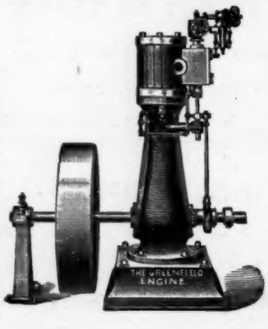
The Roessler & Hasslacher Chemical Co.,

100 WILLIAM STREET, NEW YORK.



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Established 1874.

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ENGINES AND BOILERS.

Also Horizontal, Automatic and Variable Cut-off Engines.

Sizes from 3 to 75 Horse Power.

Also Vertical and Horizontal and Marine Boilers. Steam Pumps and Adams' Grate Bars.

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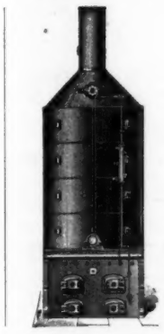

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Single Boilers or Compact Batteries.

GREAT SAVING OF FUEL AND FLOOR SPACE.
A HIGH-CLASS BOILER WITH AN UNEQUALED RECORD.
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MANUFACTURERS OF
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Coarse or Fine, Hard or Soft.

AN IDEAL COKE FOR WATER GAS.

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Shipping Facilities by River and Rail.

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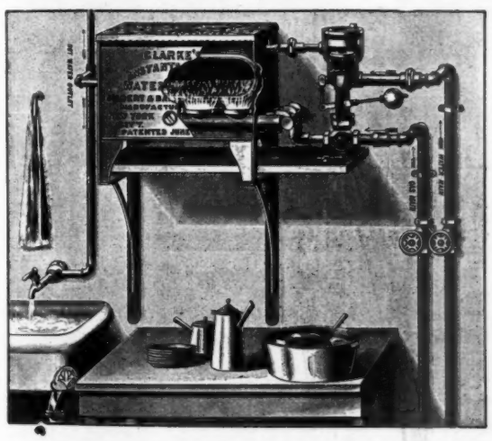

Clarke's Automatic Instantaneous Water Heater.

This Heater furnishes water heated as it flows. The act of drawing water from any faucet with which it is connected automatically turns on the gas, which is in the same way instantly shut off when the flow of water is stopped at the faucet. It will deliver a gallon of water a minute as long as required, at a temperature 80° higher than it is delivered to the Heater; or it will deliver a less amount at a higher temperature, or a greater amount at a lower temperature, as may be determined by regulating the flow at a faucet. We have testimonial letters from those using it in Private Residences, Factories, Barber Shops, Restaurants, Stables, Laboratories, Stores, Churches, Commercial Buildings (for scrubbing), Banks, Clubs (baths, shower baths and sprays), Hotels, Riding Academies (baths and shower baths), and Patrol Stations

Price, $50.00. 12 inches wide, 15 inches high, 30 inches long. Weighs 86 lbs.

GILBERT & BARKER MFG. CO., - 82 John St., New York City.

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WELSBACH STREET LIGHTING COMPANY OF AMERICA,

——OWNS, CONTROLS AND OPERATES——
EXCLUSIVELY

THE NEW IMPROVED AND PATENTED STREET LIGHT BURNER.

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Our PATENTED "STREET LIGHT APPLIANCES" have made WELSBACH STREET LIGHTING a complete success.

By the UNIFORM DISTRIBUTION of light on scientific principles a greater area can be lighted by our system and more economically than in any other way.

Where there are no gas mains already laid, we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, enabling Gas Companies to furnish a uniform light in all localities.

Our System is in practical use in many cities, among which we may mention

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CORRESPONDENCE SOLICITED FROM GAS COMPANIES AND OTHERS INTERESTED IN MUNICIPAL LIGHTING.

BRAY'S BURNERS

Are Suitable for All Pressures and Conditions, and for Efficiency, Economy and Durability are Unrivaled.

Producing a steady, well-shaped flame with burner cock turned on full. Prevent waste of gas, broken globes and dissatisfied consumers.

As Sole Agents in the United States for GEORGE BRAY & Co., we carry a full stock of all sizes for High and Low Pressures. Send for Prices and Special Pamphlet, or order a sample gross, stating your average house pressure.

Every Burner is stamped with name and trade mark. Cheap and inferior imitations are constantly coming in and going out of use, and we respectfully warn the trade against this kind of deception, as it causes loss and discredit to the trade and damage to the gas industry.

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Gas Logs, Fires, Heaters,
OF ALL KINDS.

GAS GOVERNORS,
GAS FURNACES,
and everything pertaining to the use of Gas.

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Special Line of
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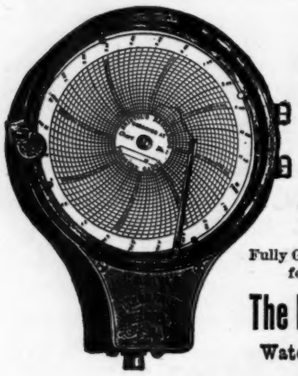

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Simple in Construction, Accurate in Operation Low in Price.
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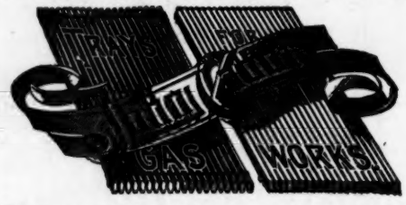

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ON THE CONSTRUCTION AND WORKING OF
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A. M. CALLENDER & CO., 32 Pine Street, N. Y.

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Has been made by
WILDER'S VOLUMETRIC GOVERNORS.
They control the pressure at the burner, and deliver the quantity for which they are set regardless of high or low pressure in the supply.
WELSBACH LIGHTS are fully controlled, and the governors soon pay for themselves by preventing the breaking of mantles and chimneys. Thousands are already in use. Orders may be given to the Welsbach Co., or sent to ourselves.
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CHEMICAL PRODUCTS DERIVED FROM COAL AND COAL TAR,

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Order Recently Received—16 Machines, each for 3,500,000 Cubic Feet per day.

The Patentees of the above, after several years' experience, finding that the enormous weight of the iron sheets (forming the washing discs) caused undue wear of the shafts and consequent fractures of the latter, introduced their Patent Wooden "Grid Segments." These "segments" have now been fitted in some hundreds of Patent "Standard" Washer-Scrubbers, and are universally admitted to be a great improvement upon the out of date pattern.

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GASHOLDERS, with or without Steel Tanks.

Purifiers, Condensers, Scrubbers. Oil Tanks, Smoke Stacks.

STEEL ROOFS and BUILDINGS.

PLATE AND STRUCTURAL WORK OF EVERY DESCRIPTION.

THE ANDERSON Patent Cutter Carrying Link
Made in all sizes.

Will cut from 2 in. to 24 in.
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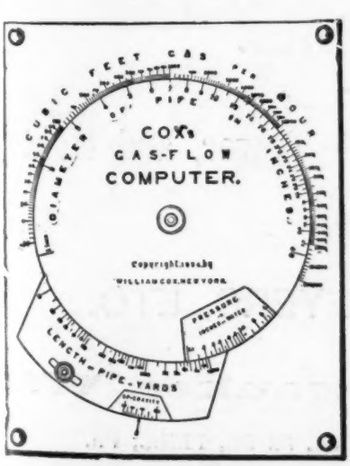

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It Prevents Errors and Saves Hours of Tiresome Calculations.

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Complete Works Erected with Guaranteed Results.

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Coal and Water Gas Plants,

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Recuperative Furnaces, Washers, Condensers, Purifiers, Purifying Machines.

Gas Enriching Plants to Enrich Coal Gas up to 24 Candle Power, and Making a White, Bright, Non-smoking Gas.

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LATEST IMPROVED GAS EXHAUSTER

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GUARANTEED TO REGULATE WITHIN ONE-TENTH OF AN INCH, WATER PRESSURE.

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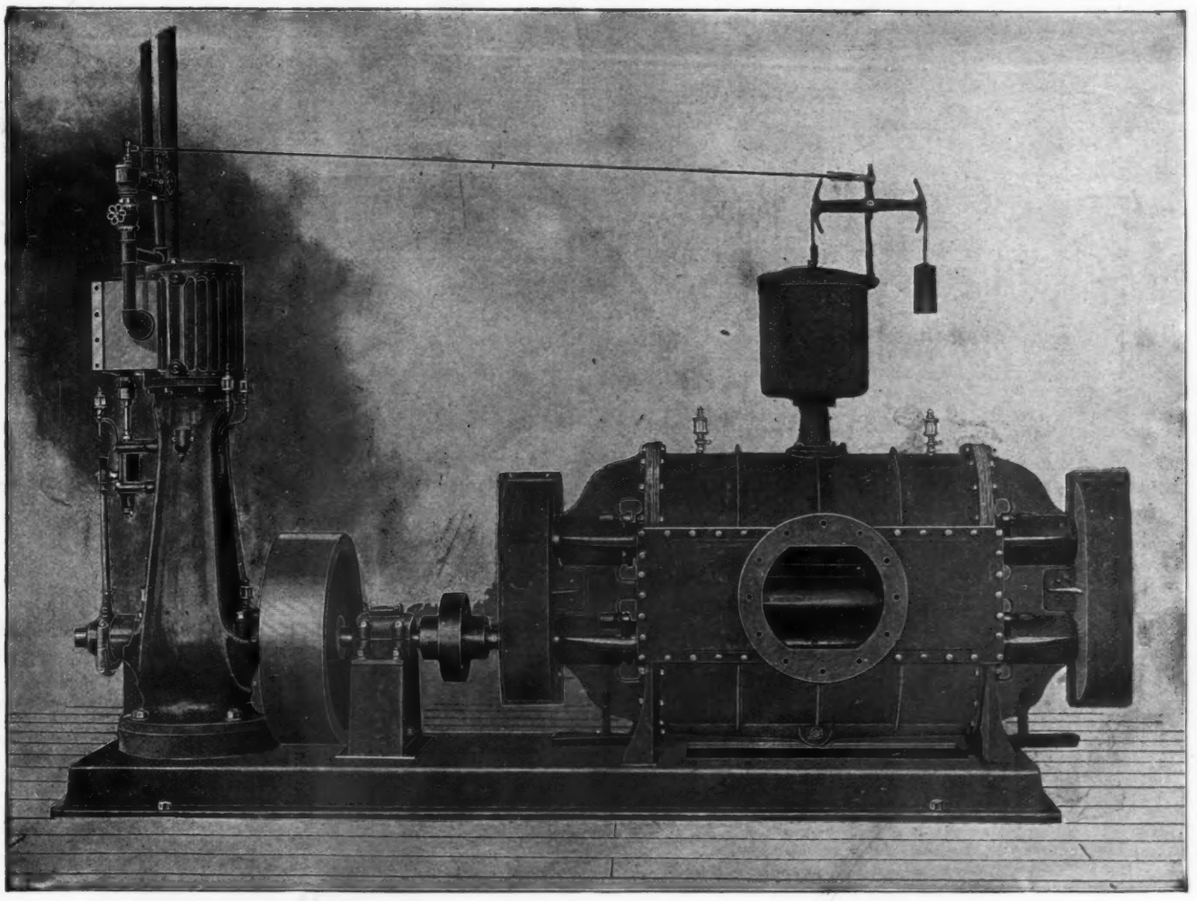
EASIER TO ADJUST THAN ANY OTHER GOVERNOR.



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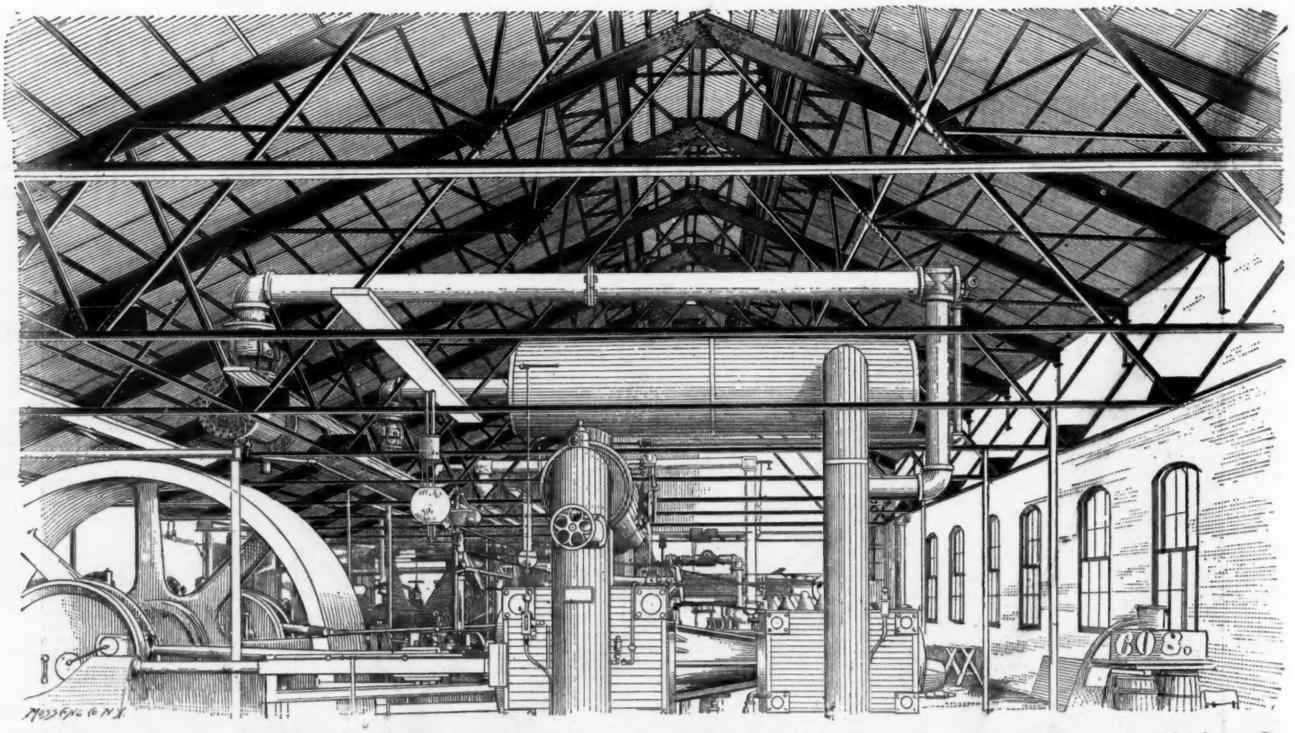

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ADVICE AS TO IMPROVEMENT OF GAS PROPERTIES AND MANAGEMENT.

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Price $1.

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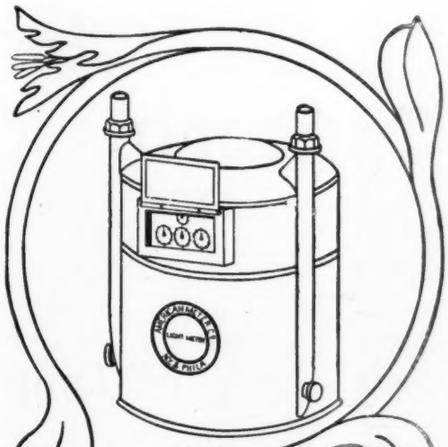

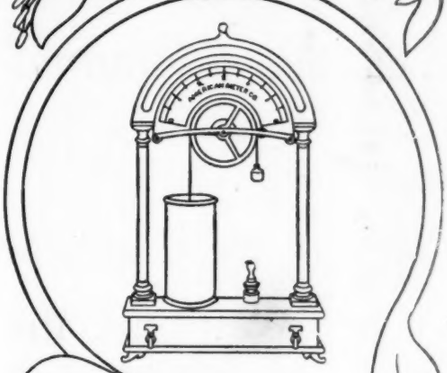

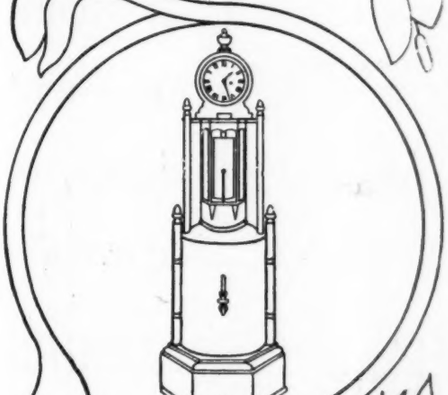

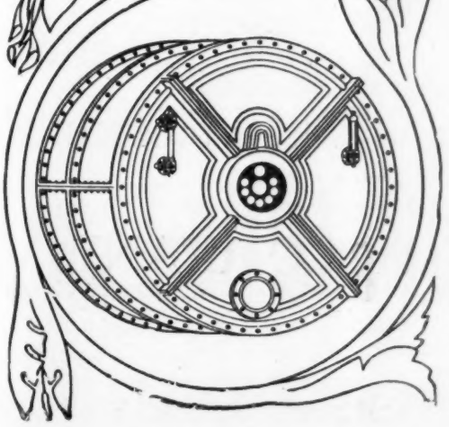

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SAN FRANCISCO.

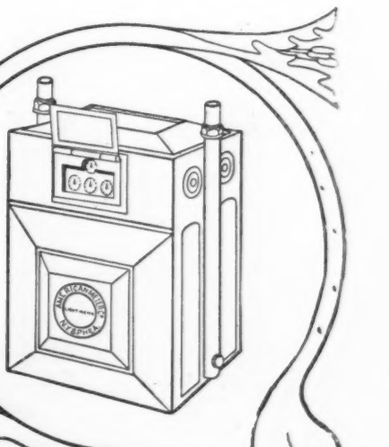
PUBLIC LIGHTING TABLE.

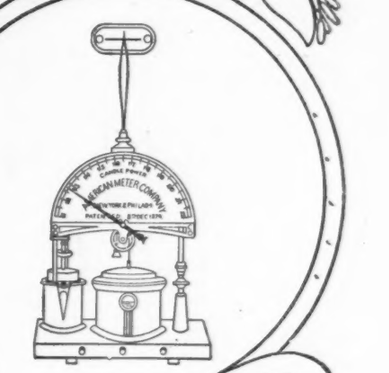
DECEMBER, 1897.

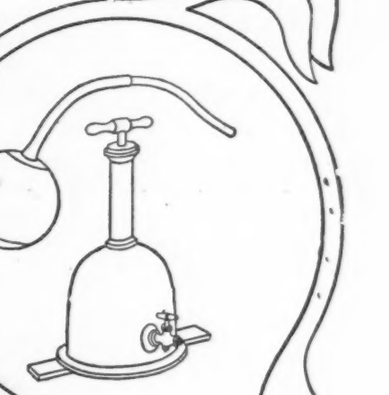
Day of Week.	Date.	Table No. 1. FOLLOWING THE MOON. Light.	Extinguish.	Table No. 2. NEW YORK CITY. ALL NIGHT LIGHTING. Light.	Extinguish.
				P.M.	A.M.
Wed.	1	11.50 PM	6.00 AM	4.20	6.10
Thu.	2	12.50 AM	6.00	4.20	6.10
Fri.	3	1.50	6.00	4.20	6.15
Sat.	4	2.50	6.00	4.20	6.15
Sun.	5	3.50	6.10	4.20	6.15
Mon.	6	4.50	6.10	4.20	6.15
Tue.	7	No L.	No L.	4.20	6.15
Wed.	8	No L. FM	No L.	4.20	6.15
Thu.	9	No L.	No L.	4.20	6.15
Fri.	10	5.00 PM	6.40 PM	4.20	6.20
Sat.	11	5.00	7.40	4.20	6.20
Sun.	12	5.10	8 50	4.20	6.20
Mon.	13	5.10	9 50	4.20	6.20
Tue.	14	5.10	10.50	4.20	6.20
Wed.	15	5.10	12.00 AM	4.20	6.20
Thu.	16	5.10 LQ	1.00	4.20	6.20
Fri.	17	5.10	2.10	4.20	6.20
Sat.	18	5.10	3.20	4.20	6.20
Sun.	19	5.10	4.40	4.20	6.20
Mon.	20	5.10	6.20	4.20	6.20
Tue.	21	5.10	6.20	4.20	6.20
Wed.	22	5.10	6.20	4.20	6.20
Thu.	23	5.10 NM	6.20	4.20	6.20
Fri.	24	5.10	6.20	4.20	6.25
Sat.	25	5.10	6.20	4.20	6.25
Sun.	26	5.10	6.20	4 20	6.25
Mon.	27	5.10	6.20	4.20	6.25
Tue.	28	9.30	6.20	4.20	6.25
Wed.	29	10.40	6.20	4.20	6.25
Thu.	30	11.40 FQ	6.20	4.20	6.25
Fri.	31	12.40 AM	6.20	4.20	6.25

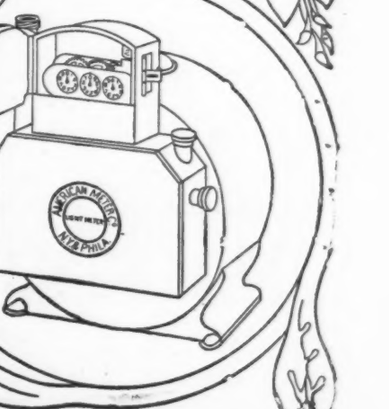
TOTAL HOURS LIGHTING DURING 1897.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January	233.00	January	423.20
February	187.20	February	355.25
March	202.00	March	355.35
April	170.40	April	298.50
May	163.00	May	264.50
June	140.40	June	234.25
July	151.40	July	243.45
August	167.30	August	280.25
September	174.40	September	321.15
October	200.00	October	374.30
November	205.20	November	401.40
December	220.10	December	433.45
Total, yr.	2216.00	Total, yr.	3987.45









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NOTICE is hereby given to all PURCHASERS and USERS of the so-called "Sunlight" lamp that suits will be brought against them for DAMAGES for INFRINGEMENT of the Letters Patent of the Welsbach Light Company, and will be prosecuted vigorously.

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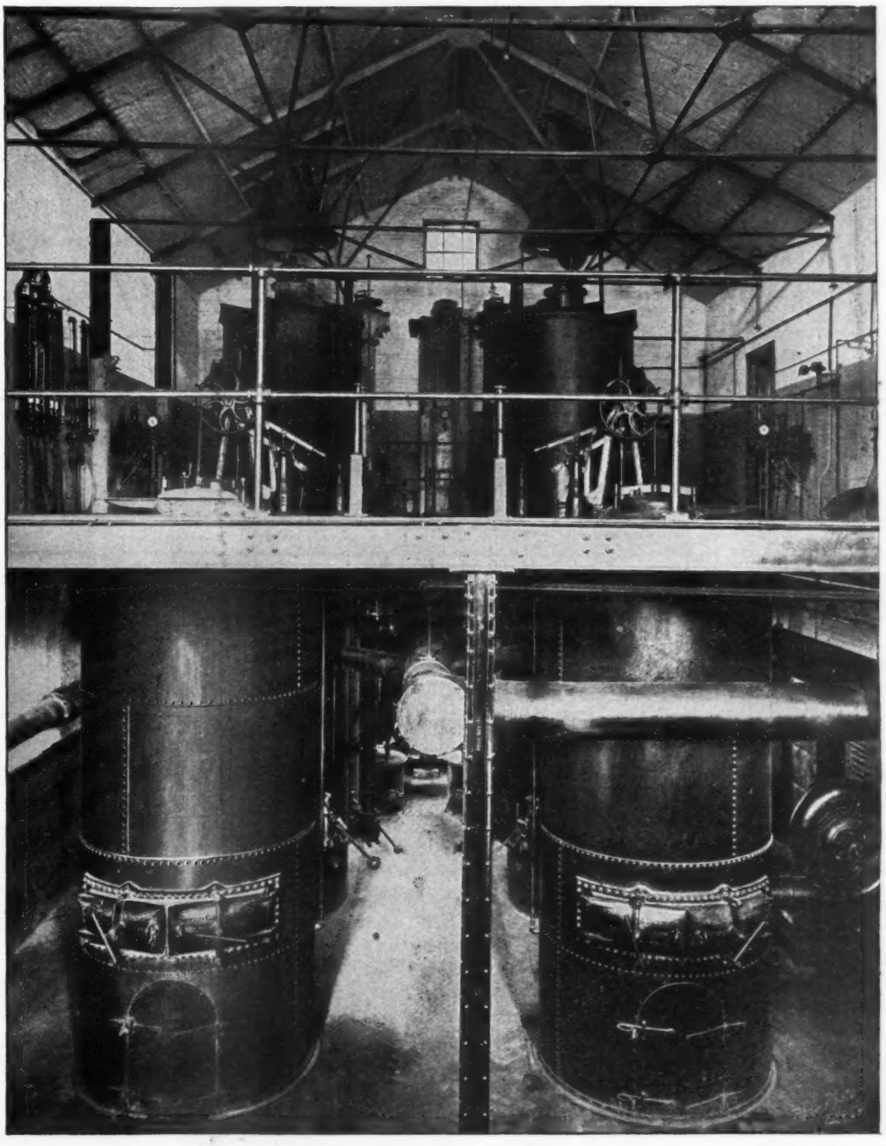

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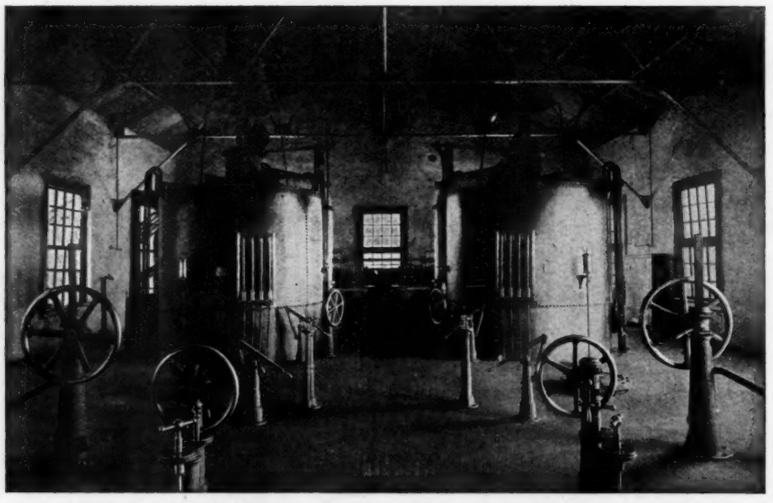

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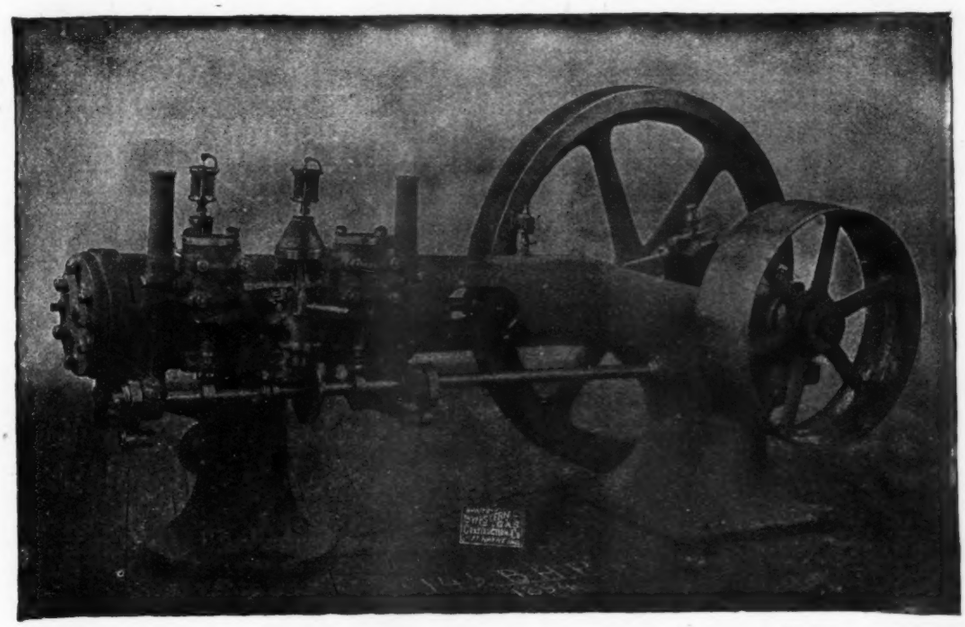

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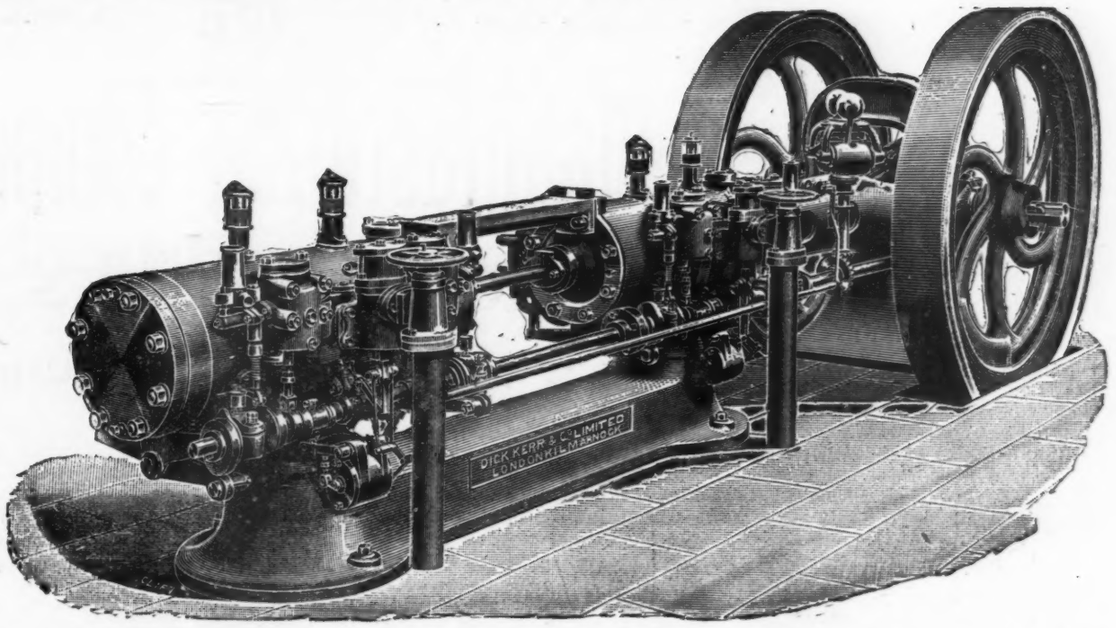

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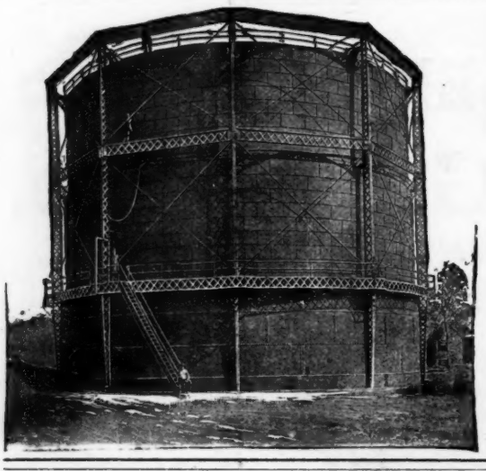

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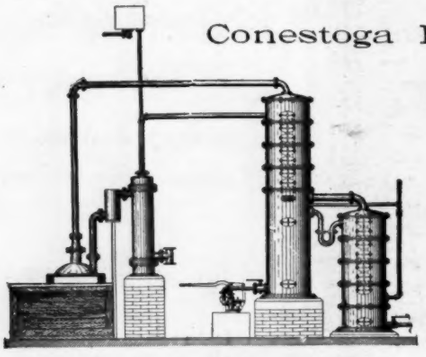

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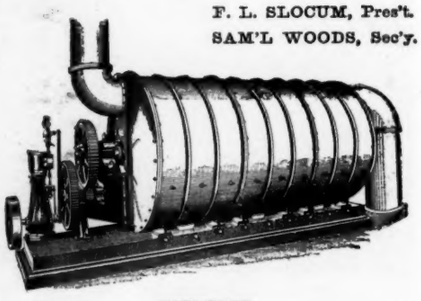

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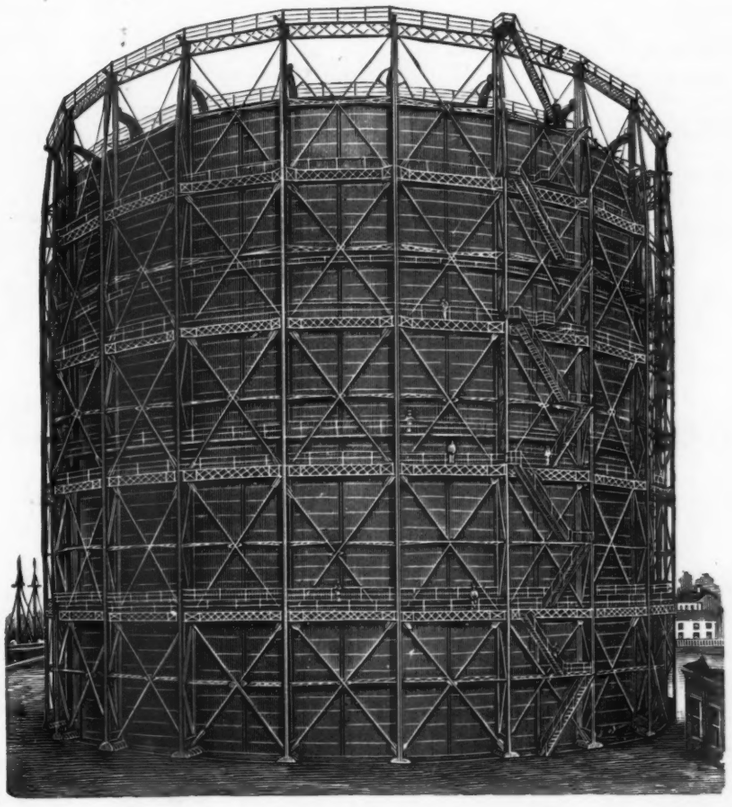

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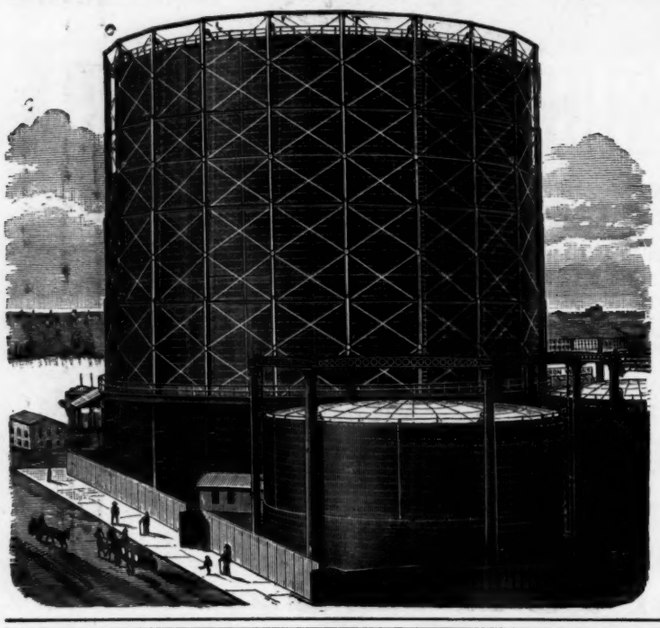

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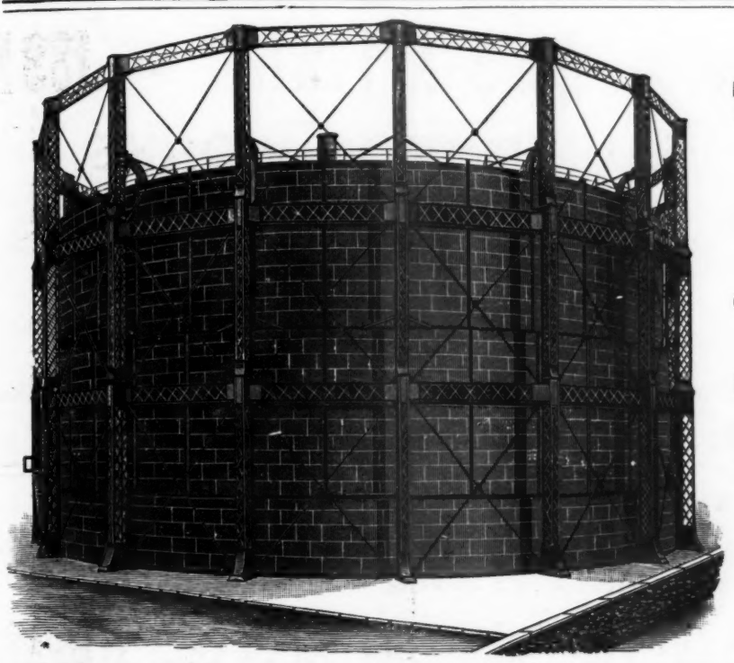

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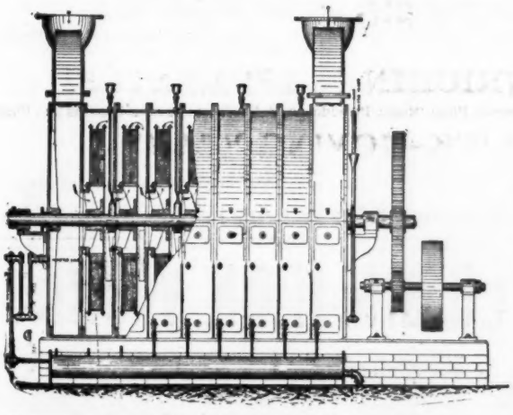

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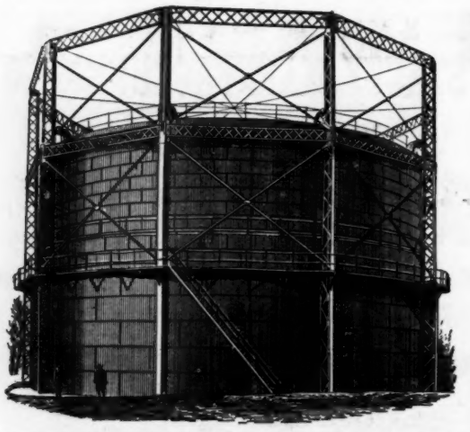

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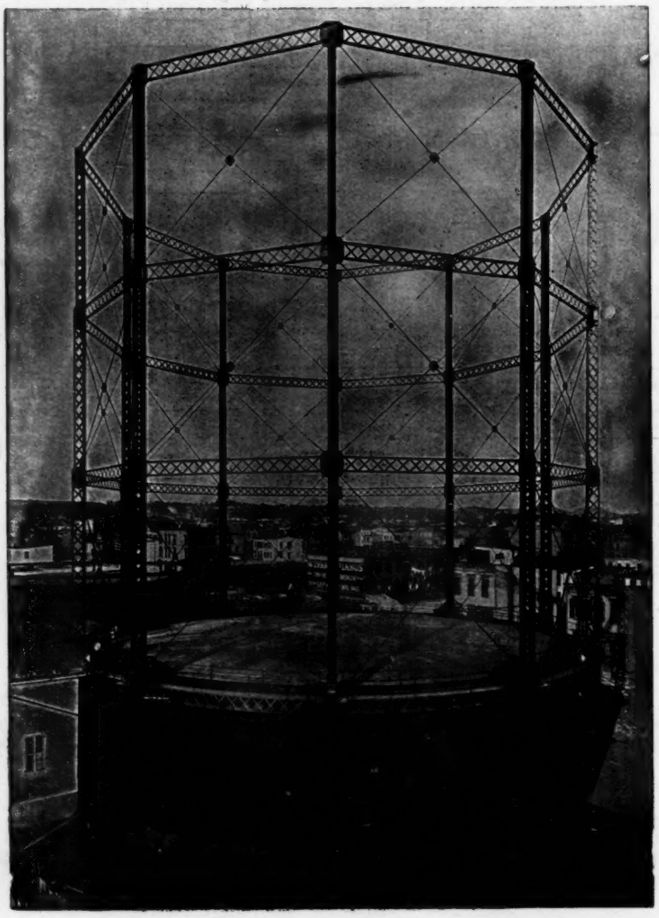

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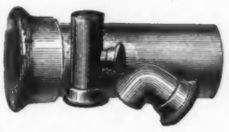

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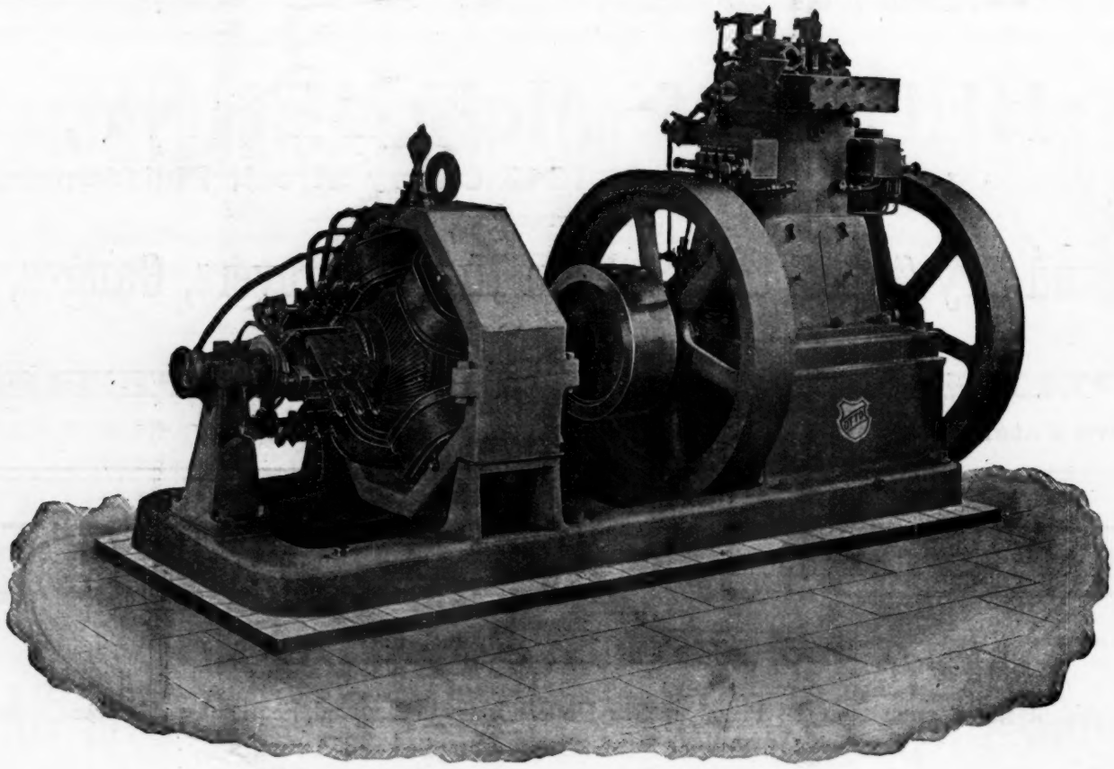

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